THE
ELECTRICAL REVIEW

Volume CXXVII — No. 3284

Friday, November 1st, 1940

Contents

	Page
Editorial : Planning for Peacetime	359
Extending Installations. By G. H. Buckle	361
Scientific Workers' Organisation	362
I.E.E. Presidential Address	363
Some Aspects of Research	364
Representation of A.C. Power. By T. F. Wall, D.Sc.	365
Power Projects in Eire	366
Electricity in Mines	366
Lighting Terminology. By Howard Long, M.I.E.E., F.I.E.S.	367
New Books	368
Personal and Social	369
Forty Years of Progress	370
Commercial and Industrial	371
Electricity Supply	373
New Patents	374
Financial Section	375
Contract Information	378

Classified Advertisements (Official Notices, Situations Vacant, etc.)	47
Index to Advertisers	64

EDITORIAL, ADVERTISING AND PUBLISHING OFFICES : Dorset House, Stamford Street, London, S.E.1
Telegraphic Address : "Ageekay, Sedist, London." Code: A B C. Telephone No. : Waterloo 3333 (35 lines)
Subscription Rates, Postage free : United Kingdom, £1 16s. 10d.; Canada, £1 12s. 6d.; Colonial and Foreign, £2 1s. 6d. per annum
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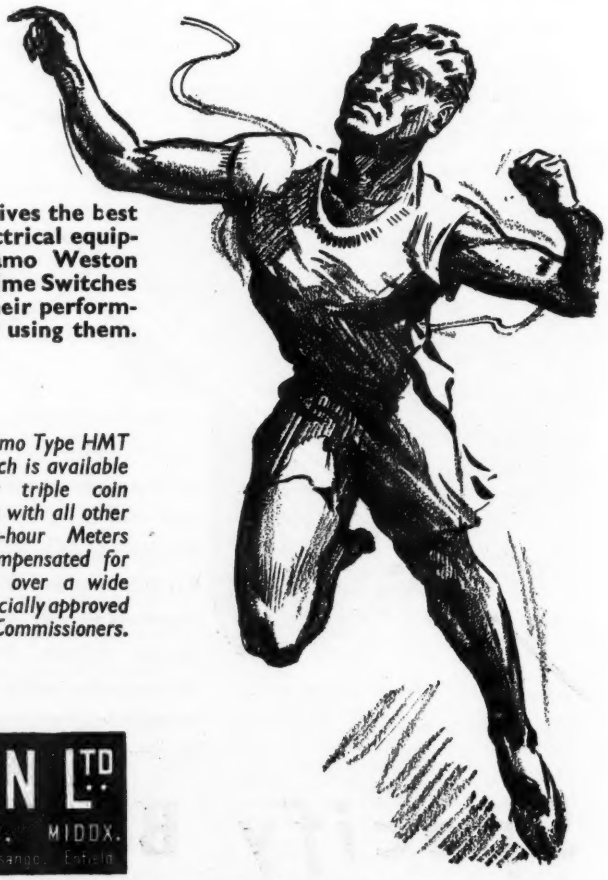

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Vol. CXXVII. No. 3284 NOVEMBER 1, 1940 Price SIXPENCE

Planning for Peacetime

I.E.E. President's Views

WHILE electrical engineers are from the nature of their calling very much preoccupied with the practical aspects of the war, they have their leisure moments when they would gladly turn their thoughts to something else. As a contrast to the present orgy of destruction, what could be better than reflections on what this world ought to become if the price now being paid is to be in some part redeemed? It will be useful, too, to spare some of our attention for the future.

If this future is to be more worthy of the labours of engineers and scientists, it will entail deliberate planning. Failure to realise this in 1918 accounts for much of to-day's troubles. As a guide to the fundamental principles involved, we commend a study of the address delivered by Mr. J. R. Beard as President of the Institution of Electrical Engineers. Unfortunately, planning is under a cloud just now as it is associated in our minds with the means adopted in some countries that can lead only to evil ends, but if the ethical approach implicit in the presidential address be maintained, the results will be in accord with it.

National Survival Involved

There are some who hold that our nation has no great inherent capacity for large-scale planning, but does best under the compulsion of circumstances when they arise. The two aspects become reconciled, however, if it be shown that the necessity of the first is forced upon us as a condition of national survival even after winning the war. One of the virtues of the President's views is that he keeps the object in sight all the time. Electrically speaking, that is to make electricity available to the greatest number of people at an economic price. The various methods of doing so he considers in their practical bearings and clear of "isms," which have always been the bane of progressive ideas.

Thus he avoids the pitfalls of so many "planners" who seem more concerned to produce tidily rounded schemes based on pet hypotheses than to serve any real needs. That, as Mr. Beard showed, on the analogy of the progress of physical sciences, is about 300 years out of date. Its worst feature is that it assumes that good administrators are common and therefore tends to encourage control by a centralised bureaucracy without the touchstone provided by commercial results, a working substitute for which is a need, even though most engineers do best when the interest of their work rather than the material reward provides the spur.

Elementary mistakes of this kind are avoided by Mr. Beard, who emphasises the need to make use of the "experimental method" in planning and recognises the value of extending and adapting existing institutions and well-tried principles to wider fields. An important suggestion is that the electricity supply industry should take the initiative in voluntarily setting up a small "Planning Council" to work out a mutually acceptable regional scheme of distribution for providing the basis of an Act of Parliament. This is no new proposal, but coming from the President of the I.E.E. it is to be hoped that it will now be taken seriously.

It would be far more in accordance with the great traditions of the supply industry if it showed in this way that it recognised its obligations as a public service, instead of waiting for a scheme to be imposed on it from above. However sound such a scheme might be, many sectional interests would no doubt fail to appreciate its merits because of the lack of understanding of the situation as a whole which discussion and subsequent action would have provided.

Systems and Tariffs

Turning to details, Mr. Beard urges, in the interests of domestic consumers, the compulsory supply of AC at 230 V. It is now ten years since the Institution issued a report of an investigation into this question, and although much has been done since then by many undertakings voluntarily, progress has been much too slow, and the longer the delay the greater the cost of the inevitable change-over. With regard to the present obligation on an undertaking to quote a flat-rate tariff this is, as Mr. Beard points out, a relic of early legislation. He would reverse the position by making a two-part tariff the sole basis of charge—a proposal with which many supply engineers will be in sympathy.

These are details only, but probably if it had not been for the quite reasonable dissatisfaction of consumers on account of voltage and tariffs, there would not have been the public pressure for the reorganisation of distribution. From the vista opened in the presidential address as a whole, it is evident that peace when it comes will not be a time for taking things easily. It will be a continuation of our strenuous national effort, but designed for constructive purposes.

Factory Lighting

WHILE the Draft Regulations for the interior lighting of factories issued last week fully endorse the recommendations made by the Departmental Committee in its Fifth Report, the proposed Statutory Order is to be regarded in one respect as an emergency measure. This limitation is due to the compulsory application of the new provisions only to factories (not including electrical stations) in which work is carried on for more than forty-eight hours per week or in shifts. That is not because a minimum of 6 ft.-candles at bench level is unnecessary in other factories, but because to enforce the standard in all cases would probably be impracticable at present in view of possible shortage of suitable fittings. Owners of existing premises will be able to get a good idea from the table in the Report relating wattage to mounting height and spacing distance as to whether their installations comply with the requirements. Nevertheless, since the values given depend upon the use of efficient lamps and well-designed fittings and reasonably close maintenance of the initial standards, together with such factors as the colours of the walls and ceilings, owners would be well advised to seek advice. There should be no difficulty in getting help in this way either from an illumination specialist, from the supply undertaking or from the Joint Electric Lighting Committee at 2, Savoy Hill, London, W.C.2.

Glare

QUALITATIVE aspects of illumination are as important as the number of ft.-candles in promoting working efficiency, and here again the Draft Regulations follow the Fifth Report. Since the source of light will almost certainly have a brightness of more than 10 candles per sq. in., reflectors of suitable depth or diffusing bowls will have to be provided in order to prevent glare. Local lights must, of course, be completely screened, while the avoidance of deep shadows and also of dazzle from brightly polished surfaces has also to be prevented in order to comply with the new code. The owners of many factories which do not run continuously will no doubt desire to effect improvements and much can be done in this way with a little ingenuity and at little expense by engineers having experience of illumination practice.

Problems of Transmission

FOR adequate comprehension of recent advances in AC transmission-line technique new ways of approach are necessary. While the vectorial method of representation described by Dr. T. F. Wall in this issue (a method that appears to be almost unknown in this country) may not, at first glance, impress the practical electrical engineer as being a particularly easy one, actually it provides a relatively simple tool for dealing briefly with a large number of problems which have to be faced if progress is to be made, but which are otherwise capable of solution only by means of involved and difficult treatment.

Power Factor

WHILE undertakings in Great Britain can protect themselves by means of tariff penalties against the effects of low power-factor in consumers' installations they cannot withhold supply on the ground that a certain standard is not reached. On the other hand, under a revised code shortly to become effective in Wisconsin, U.S.A., undertakings there are authorised to disconnect or refuse to connect discharge lamps unless the power-factor reaches 90 per cent. lagging for illuminating tubes and 85 per cent. for advertising signs fed from a single transformer rated above 225 VA, and the onus is placed on the consumer to install the corrective devices. This introduces a different principle from any followed in this country, where official regulations generally are concerned only with safety and adequacy of supply.

Water-power in Ireland

IN addition to the Rivers Shannon and Liffey, which are now harnessed to provide electricity in Eire, the River Erne could, it is estimated, be exploited economically for the same purpose. This river has a catchment area of about 1,600 sq. miles, nearly half of which is in Northern Ireland. It seems clear that if its potentialities are fully developed, both for producing power and for drainage improvement, co-operation between the two peoples will be essential and to their mutual benefit. If the project is carried through to a successful conclusion, it will provide one more illustration of how far engineering practice may be in advance of political theory.

Lights in Shelters

WE have already referred to the warnings issued by electricity supply engineers with regard to the danger of employing improperly installed lights in air-raid shelters—a warning that has unfortunately been proved to be very necessary. Now the British Electrical Development Association has issued a general public statement emphasising a number of points. The practice of running a flex from a house to a shelter is condemned and consumers are advised to consult their supply authorities before installing electricity in shelters. So far as the Anderson type is concerned the use of low voltage is strongly recommended as it entirely eliminates the risk of shock. It is too much to ask that supply authorities should inspect all the shelters in their areas, but they should at least see that their consumers are made aware of the dangers and the way to avoid them.

A Remarkable Increase

THE total value of exports of United Kingdom goods during September was £31,177,290, an increase of 35 per cent. upon the September, 1939, figure. This was very satisfactory but almost pales into insignificance when the increase in exports of electrical goods and apparatus is considered. The value of these (£1,134,008) was double what it was in the corresponding month of last year, although it has to be admitted that the advance, as compared with September, 1928, was only £103,300. At the same time there was a sharp decline in imports of electrical goods, amounting to 27 per cent.; the decline from the September, 1928, figure was 65 per cent. The position with regard to machinery exports (including electrical machinery) was more satisfactory than it has been, the total rising in September by 21 per cent. upon the September, 1939, figure, although it was still 38 per cent. below the total for September, 1938.

Extra Rates

THERE is jubilation in some quarters that Hove, in spite of many difficulties, has been able to transfer about £4,000 from the Electricity Department to the rate fund. Whether electricity consumers will join in the chorus of approbation is perhaps doubtful. They already have to bear a 10 per cent. increase in charges, and Mr. F. Swarbrick, the electrical engineer and manager, says in his report for 1939–40:—"Unless there is some improvement in events during the coming winter to increase the units sold, I am afraid this 10 per cent. increase will be insufficient to counteract the decreased sales." So, once again, electricity consumers are paying more than their fair share of the rates; true, the amount is only about 5s. a head, but the principle is a bad one.

EXTENDING INSTALLATIONS

Alterations for War-time Production

By G. H. Buckle

AT the present time many new factories are being planned and built for various national purposes. Production, however, can in many cases be obtained more quickly by adapting existing buildings to suit the conditions. Also, many factories already employed in the production of goods of great national importance have had to be reorganised in order to comply with black-out and other A.R.P. requirements. In these changes, except for the introduction of new plant and machinery, the electrical installation is more affected than perhaps any other service.

Existing installations have in some cases to be adapted or redesigned to take care of the following conditions :— (*a*) Provision of alternative electricity supplies. (*b*) Modifications to power distribution to suit new plant. (*c*) Black-out precautions. (*d*) Increased lighting to enable full production to be carried out under black-out conditions. (*e*) Arrangement of air-raid and fire warnings and general control.

Mr. G. H. Buckle

Alternative electricity supplies to large factories can be arranged most satisfactorily by the provision of two works substations, fed either from separate power or transforming stations or by feeders following different routes. Each substation need not be capable of taking care of the whole of the factory load as, in emergency, vital plant and lighting only need be kept running until repairs have been effected. It has been found in practice that two-thirds of the full load supply available from either substation is a very convenient figure. For factories of moderate sizes, containing possibly one transformer station, arrangements can be made by the supply undertaking for interconnection between other users so that each factory is in effect fed by its own transformer and that of a neighbour.

Where process steam is used continuously throughout the year a back-pressure generating plant can most usefully be employed. Many undertakings will allow, subject to reasonable restrictions, such plant to be paralleled with their own system, thus allowing the owner's generating plant to be used for providing general supplies as well as in the case of a failure of the public supply.

Diesel or petrol electric generating plant can be installed for the same purpose, but as it could not generate at costs comparable to those with a back-pressure steam engine, it would be held entirely for emergency purposes. Such plant is preferably housed well away from the supply undertaking's transformer room or intake point in order to prevent both means of supply being damaged by the same explosion.

Power Distribution

Where a new product is to be manufactured and new plant or machinery has to be installed, the existing distribution system may not always be readily adapted. For example, many shops contain machine tools of the cone-pulley type drive from countershafts, while new machine tools are almost invariably individually motor-driven.

Although for many reasons, such as flexibility and better lighting, the individual motor drive has many advantages, the total nameplate horse-power of motors for a group of tools would be much larger than that of a motor driving the lot by means of the conventional shafting and belting.

Similarly, the power-factor of the collection of small motors would be much lower than that of a line-shaft motor. Also, if full advantage is to be taken of the flexibility of the individual motor drive, means must be provided so that machine tools can be installed and connected in almost any part of the building. The distribution system has, therefore, to be revised to enable motors of relatively small HP, say from 1 to 15, to be connected at any point instead of motors of 15-100 HP at specific points only. This object is usually achieved by the provision of an overhead busbar system, whereby machine tools can be plugged in anywhere in the line.

Busbars are available in convenient lengths of 12 ft. and capable of carrying 200 or 250 A. They should be fed in the centre to avoid excessive voltage drop at the remote ends. Busbars are unnecessary where only a few individually driven machines are installed, as these can quite well be taken care of by the usual fuseboard and conduit systems. Connection between machine tools and busbar can be made in either conduit or flexible metallic tubing. In the latter case, however, it is advisable to run for at least 3 ft. above the machine tool in solid conduit so as to prevent coolant being splashed on the flexible tubing.

A great point to remember when installing individual motor-driven tools in place of a line-shaft is that the motor and its attendant control gear must be brought into much closer proximity to the operator and therefore efficient earthing is of paramount importance. The connection to a busbar must be protected at the bar by suitable fuses and the motor or motors on a machine tool must be provided with an isolating switch. The control for stopping and starting a motor, usually a push-button-operated contactor, must be placed near to the operator so that he or she can stop the machine in emergency without moving from the normal working position.

I consider that the ideal method of feeding an overhead busbar system is in the centre, the feeder being taken from a main circuit-breaker in a substation and protected in the shop by a suitable fuse-switch. Where, however, individual machines supersede a line-shaft arrangement, it may so happen that the original circuit wiring to large motors can be used for feeders to busbars, if suitable protection is provided.

Where extensions to wiring systems have to be made for processes which are new to the particular works, it is as well to examine carefully the various types of wiring which can now be used and not simply to use conduit and v.i.r. as a matter of course.

Pickling, etching and plating shops, and in fact any place where acid fumes are present, can be most effectively wired in tough-rubber covered cables supported on teak or similar bearers with non-metallic junction boxes, switch boxes, etc., and lighting fittings of the wellglass type with hard-rubber housings are very suitable. In heat-treatment departments, boiler houses and other buildings where high temperatures are likely to be met the Pyrotenax wiring system is much more satisfactory than a conduit and v.i.r. job. The same system is also to be recommended where there is fire risk as the cables can withstand any temperature, short of the melting point of copper, without detriment.

Black-out Precautions

The question of black-out resolves itself into whether the management desires to provide shutters or blinds so that artificial lighting is not needed during daylight hours, or whether it is decided to black-out permanently and work under artificial lighting.

At the beginning of the war most large factories blacked out entirely, working day and night under artificial light. Very soon, however, various types of blinds and screens were developed, which usually blacked out 50 per cent. of the daylight, screens, blinds or shutters being provided for the remainder. Although they are not used to a very large extent at present, electrically operated shutters are available and should become increasingly popular. A point not to be lost sight of is that although shutter and blind

arrangements are expensive, their cost can be recovered in two or three years by the saving in energy alone.

Light traps have to be provided for all entrances and exits to buildings, but great care should be taken to see that they are not air traps also. Many of the complaints of fatigue which are sometimes thought to be due to working continually in artificial light are really attributable to lack of ventilation.

This brings us to the question of intensity of lighting during black-out hours. General experience has shown that for machine shops, etc., an intensity of 20 ft.-candles is about the optimum figure. Less intensity causes fatigue due to eye strain, while a greater intensity, although desirable for many specialised processes, is likely to prove expensive in installation. Running costs and careful tests have been made by many authorities, including the Lighting Service Bureau, which show that 20 ft.-candles is the most suitable figure to work to.

General lighting is advocated for modern shops, such as that obtained by the use of dispersive metallic reflectors placed at reasonably high levels. This system, however, does not necessarily give good results where a large amount of line-shafting and counter-shafting is installed. In such cases it is better to reduce the size of the lamps and fittings, to increase their number, and to bring them below the level of the mill gearing.

Avoiding Gloom

In order to avoid an aura of gloom above, many people have found it advisable to put in a certain amount of indirect lighting which obtains its reflection from the roof. The roof should be painted a light colour so as to enhance both daylight and artificial lighting effects.

However good the general lighting of a shop is, individual lighting is essential for certain jobs or processes. This should invariably be of the low-voltage kind, 25 V being very conveniently best afforded by means of a small combined transformer-plug unit. Such lighting, however, should not be used in lieu of, but as an adjunct to, a good standard of general lighting.

Lamps for general lighting purposes consist of the ordinary incandescent lamp and the uncorrected and fluorescent partially corrected mercury-vapour lamps. There is also the sodium discharge lamp but the intensely yellow characteristic of its light limits its field of application. The question of which type of lighting to use depends almost entirely on the type of work which is carried out and the cost of energy. Discharge lamps and their fittings are considerably more expensive than the incandescent type but, owing to their much higher efficiency, their running cost for the same light output is much less.

Generally, in machine shops the plain mercury discharge lamp is entirely satisfactory. For certain inspection operations the fluorescent corrected variety gives better results, while some people favour the use of corrected lamps throughout the installation as the light is more pleasant. The lamps, however, are considerably more expensive and the efficiency is about 10 per cent. lower.

Ordinary incandescent lighting of a high standard is very pleasant to work under, but as the energy consumption is likely to be around twice that of an equivalent discharge installation, the economics depends entirely on the price of energy available.

Lighting Costs

It has been found in practice that where lighting is in use for most of the day and where energy is under 0.5d. per kWh, the standard incandescent lighting will about equal the discharge in total cost per annum, that is to say, initial cost of fittings, lamp replacements and energy.

Textile, food, cosmetic and similar production factories, printing works, etc., however, generally demand the standard incandescent lighting but, in some cases, the fluorescent colour corrected variety is satisfactory. Tubular gaseous discharge lamps giving a light approximating almost to daylight, are now available and are most useful for inspection work and anywhere where colour corrected light of even distribution and high intensity is required.

Where discharge lighting is favoured, pilot lighting of the incandescent kind should always be installed, as the discharge lighting requires some time to regain its full brilliancy after an interruption of supply.

Before the war most factories had several warning and control systems, such as hooter signals for stopping and starting work, bells for fire warnings, internal telephones and staff locator systems. As the use of hooters and bells which are audible outside the works is prohibited (except by special arrangement) the control and location of staff is rendered doubly difficult when they have been dispersed to air-raid shelters. In this case an internal telephone system, in conjunction with microphones and loudspeakers, is capable of affording complete control and separate fire bells and A.R.P. sirens are not necessary.

The internal telephone system, which can well be of the automatic type, is used for all internal works communications and also for giving warnings and instructions to key men regarding air-raids or fires without alarming the whole of the personnel, while the microphone and loudspeaker system is used for broadcast messages or instructions, or to provide music.

The control of the loudspeaker system is so arranged that fire or raid warnings take precedence over all other business and both sound generators and gramophone records are kept available to produce the necessary signals. I strongly recommend that the loudspeaker system be extended to the air-raid shelters.

I have not specifically mentioned air-raid shelter lighting, as this subject has been covered in various B.S. Specifications, but experience has shown that the batteries advocated are entirely satisfactory if a proper system is employed of regularly charging and discharging them and if a log of their condition be kept.

In conclusion, I would like to stress the importance of good lighting and to state emphatically that I know of no way of obtaining a greater return for one's money than by spending it on good lighting, particularly under black-out conditions, and that generosity in lighting is not contrary to national interests, as, fortunately, plenty of lamps and fittings are available.

Scientific Workers' Organisation

As a result of a demand for the more complete organisation of scientists and engineers made at a series of conferences called by the Association of Scientific Workers in March and April, 1940, invitations were sent to several organisations to send representatives to a meeting at which possible collaboration could be discussed. It was proposed that this collaboration should take the form of the calling of joint meetings or conferences in various parts of the country with the object of informing scientific and technical workers of the possibilities of organisation in defence of their economic interests. It was further proposed that a permanent joint committee should be set up as an advisory and co-ordinating body.

While it has not been found possible to hold the further conferences proposed, a National Joint Committee for Scientific, Technical and Engineering Supervisory Staffs has now been established, and the bodies represented are :—The Association of Scientific Workers, the Association of Supervising Electrical Engineers, the Association of Teachers in Technical Institutions, the Electrical Power Engineers' Association and the National Foremen's Association.

Observers have been sent to the meetings of the Joint Committee by the British Association of Chemists, and the Guild of Public Pharmacists and other interested bodies are being invited to join the Committee. The objects are to assist participating organisations or their members in improving the conditions of employment of scientific, technical and engineering supervisory staffs ; to advise upon the preparation for the guidance of employers of model terms of service ; to assist in making representations to employers on behalf of their members ; to discuss any proposed activities of these organisations, or any other matters of common interest.

It will also arrange, or assist in arranging, meetings for the discussion of matters of scientific or economic interest, and social functions ; arrange for the interchange of views between the members of participating organisations ; encourage employees to join the organisation most appropriate to their employment, represented on the Committee ; and co-operate with other organisations having similar objects.

The Committee is encouraging the setting up of regional committees to facilitate local co-operation in matters of common interest. It has already performed valuable services in giving advice and support on questions of negotiation, internal organisation, basic salary scales, etc.

LOOKING TO THE FUTURE

I.E.E. Presidential Address

THE principal theme of the address delivered on October 24th by Mr. J. R. Beard as President of the Institution of Electrical Engineers was the importance of preparing now for the post-war future.

He commenced with a survey of the Institution's affairs. Its membership of over 20,000 made it the largest British professional body; a fifth of the membership was overseas. Members on active service numbered 1,285, most of them in technical capacities. About 96 per cent. of members eligible for enrolment in the Central Register had submitted particulars. The I.E.E. Placing Panel had put forward 3,475 names, resulting in over 550 appointments up to September 18th. In various ways assistance had been rendered to members in ensuring that their qualifications were properly used.

The President then turned to his main subject, saying that engineers must necessarily play a major part in rebuilding the world after the war and they must prepare and equip themselves for the task now, keeping in mind fundamental problems of planning other than technical ones. Although after the last war technical achievements had fulfilled expectation there had been no clear idea of the purpose for which those technical achievements should be used and inability to co-operate with non-technical interests in building the efficient and useful structure which the community needed.

Continuing the Struggle

The British loathed the so-called "new order" of the dictators but it was agreed that there could be no return to the "old order." The post-war period would not be a period of "peace" but a continuation of the present struggle for constructive, rather than destructive purposes. The object in wartime planning was well-defined and planning was willingly accepted. To secure equal acceptance of peacetime planning there must be a general agreement by society upon common ideals.

The abuse of technological progress was largely due to the aloofness from politics of engineers and scientists whose education was narrow and over-specialised, ignoring the "humanities." Their ideas must be widened and they must be trained for political action in the widest sense.

Planning was compatible with a free society provided the freedom of the individual did not conflict with the rights of others. It was fortunate that altruism, unselfishness, tolerance and even humour were reinforced by motives appealing to the self-interest of the individual, but one of the main incentives to human effort was the acquisition of power to control men through money or through position. There was a need for the education of those affected to get them to appreciate the benefits of planning and to subordinate individual idiosyncracies to the good of the whole.

After stating that education for planning could only have its full effect if it was itself planned, Mr. Beard put forward a number of suggestions to ensure that essential matters should not be neglected and he advocated a greater use of the experimental method in planning to ensure that it was on the correct lines. This method should above all be applied to the problem of adjusting production to consumption to eliminate trade-depression cycles and unemployment, which every thinking man must refuse to accept as a permanent state of affairs.

The Electrical Engineer's Part

Among the essential activities in which electrical engineers could take their share were the decentralisation of industry, the happiness and prosperity of our rural communities, the comfort of our homes and the freeing of women from unnecessary toil, largely by the elimination of smoke and dirt.

While excessive parochialism and individualism must be broken down, individual initiative and enthusiasm must not be damped by excessive centralisation. Small organisations and free competitition were rapidly passing and the principle of control of monopolistic concerns had long been recognised in this country. In these large concerns it was essential to retain the men who to-day controlled competitive enterprise, but competition in results must be substituted for competition in profits. In the last direction the electricity supply industry had set an example to other industries and the statistics of the Electricity Commissioners had been of great service in advancing the technique and organisation of the industry.

The President then turned to the application of these general principles to the planning of electricity supply with which the interests of the manufacturing side of the industry were closely concerned. It was generally agreed that there was room for improved organisation but the industry should not again wait for a scheme to be imposed from outside because of a desire to maintain sectional rights and privileges.

To avoid this, a small representative "Planning Council for Electricity Supply" might well be set up voluntarily to produce a scheme for presentation to the Government for necessary legislative action. A well-considered scheme of this nature could not be ignored by the Government and would probably be welcomed as a speedy means of settling one of the post-war problems. Mr. Beard stressed at this point that his views were given in his personal capacity and not as representing the Institution or any branch of the profession.

He then proceeded to review the history of electricity generation and distribution since the last war. Referring to the Electricity Commissioners and their functions, he said that while from a technical point of view the hesitancy to place the industry under public ownership might have been unfortunate it had become evident that the technique of public ownership was then inadequately developed and compulsorily-formed bodies would have been clumsy and inefficient.

Mr. J. R. Beard, President of the I.E.E.

Under the operations of the Central Electricity Board, in few instances was the output of a generating station absorbed by its owner; in most cases the owner was only an agent for the Board and received no direct reward. If direct ownership and operation by the Board were likely to result in appreciable economy this should be brought about, but the necessity for radical change and expansion of staff, in addition to large regional sub-organisations, would probably result in outweighing any economy effected.

The balance of advantage therefore was probably in favour of retaining the present procedure, with two desirable modifications. First, the Board might reasonably be required to make the station owner some payment based upon savings effected in fixed kilowatt and unit charges. Secondly, the Board should have power to build and operate a station at any point at which it was technically desirable to place it if the area supply authority was not able to do so.

Rewards for Large Undertakings

The hypothetical basis of charge for energy supplied by the Board was increasingly unsound. It was suggested that a logical modification should take the form of fixed permanent discounts, on the standard grid tariffs, of an amount such that if the tariffs (or discounts) were applied to the last few years in which agreements on the charges had been reached, the charges would have been the same in total. The present system of formulation of schemes by the Electricity Commissioners was cumbersome; it should be sufficient for the Commissioners to give such formal approval for most grid extensions as is normally given to extensions by authorised undertakers. The Board's aim of making cheap electricity widely available was being achieved and the surplus savings should now be passed on to the larger undertakings in recognition of the assistance which they had given without financial reward.

There was a case for reconsidering the original limitation of the Board's obligations to provide one point of supply. Maximum economy would often be achieved if supply were given at several points at the cost of the supply authority concerned.

By 1937-38 the average cost of generation had been reduced to seven-eighths of what might have been expected under unco-ordinated development, corresponding to a present annual saving of about £9,000,000. Unfortunately, the rise in the price of coal had masked the effect. In addition to the monetary saving, national planning of generation had resulted in increased availability of supply and lessened the danger from air attack. There remained, however, the vital necessity of planning extensions in time to deal with increased demand.

On the distribution side there had been no substantial measure of planning. The relatively mild proposals of the McGowan Committee had not been adopted, largely because of the opposition of certain sections of the industry. But the industry existed for the benefit of the ultimate consumer. Some degree of national planning, combined with the more intimate regional planning, was necessary. The Electricity Commissioners should undertake the national planning and co-ordinate and guide the regional planning.

Mr. Beard limited consideration of planning to the low-voltage domestic supply as this was the side with which the general public was concerned; industrial users, on the whole, were reasonably satisfied with the service. Rapid progress had been made with the conversion of systems to the standard 230 V AC; the balance should be converted as soon as possible and the supply of AC should be made compulsory after a strictly limited interval. The cost of voltage standardisation should be borne partly by the undertaking concerned which stood to benefit by the change.

To encourage development in rural areas, the President suggested that general availability of supply should be compulsory within a limited period and that any supply authority unwilling or unable to meet this requirement might be automatically transferred to a larger authority, which was able to do so, on equitable terms.

In considering the question of the price of energy the importance of reducing distribution costs was very apparent. Although there might be exceptions, it was generally true that undertakings selling less than 20 million kWh annually for lighting, heating and cooking could not achieve the same economies as larger undertakings nor could they provide the same service to consumers. A broad policy of consolidation under some form of regional management should be initiated to reduce the number of supply authorities from over 600 to under 100. Side by side with this development the reorganisation and consolidation of local government bodies should be proceeded with.

Each of the three possible forms of ownership, municipal, company or some *ad hoc* public body, had its advantages and drawbacks. Therefore, any public consideration of grouping should be preceded by an authoritative announcement that it would be dependent upon certain basic principles. It would be made clear that grouping would only be carried out if it was likely to result in economy, with proper safeguards to the consumer and an incentive to a progressive policy. Company-owned undertakings which were retained would be granted a long extension of tenure and ultimately be purchased by a public electricity supply authority on equitable terms; there would be control of dividends and new capital. Consumers would be assured that grouping would not lead to increased prices save to cover increases in fuel or other basic costs. Although the Commissioners should be given powers to enforce grouping these powers should be held in reserve for a limited period and voluntary grouping encouraged.

With regard to tariffs, the President considered that the two-part form should be the sole basis and that there should be standardisation of the basis of the fixed charge. Either or both rateable-value and floor-area methods could be used.

Two new tariff problems were arising. Under nationally-co-ordinated generation it became important to limit the peak loads of undertakings at the time of national peak. Secondly, the growth in domestic load tended to make it control the peak which necessitated the control of the incidence of consumers' peak loads and the encouragement of off-peak consumption.

The address concluded with a survey of what had been done in the Dominions in the way of planning from which useful lessons could be learned by this country.

SOME ASPECTS OF RESEARCH

Selection and Training

RESEARCH as a subject in itself, particular fields being referred to by way of illustration, was the natural choice of Mr. B. A. G. Churcher (Metropolitan-Vickers Electrical Co., Ltd.) for his inaugural address as chairman of the North-Western Centre of the INSTITUTION OF ELECTRICAL ENGINEERS, which he delivered at Manchester on October 19th.

Primarily, said Mr. Churcher, the search was for new principles; measurement and experiment were clearly not the essence of research, since many important principles had been arrived at by pure reasoning, *e.g.*, by mathematical treatment, but the development of experimental or measuring technique or apparatus embodying new principles or notable improvements was an important part of research. In a large organisation the demand for special instruments, experimental apparatus, and other constructional work was continuous, involving a wide range of skilled operations in addition to a high standard of workmanship which attracted the best type of worker.

Selection and training were vitally important; concurrent instruction and participation contained an essential element, in that it consisted not simply in the imparting of information, but in a man's learning to think critically for himself and to face and overcome difficulties by practising the art, an expert being at hand to advise and to point out pitfalls. A preliminary instructional period was an important element in the selection of junior staff, since it added a very relevant test to impressions already gained from a candidate's academic record, his apprenticeship record, if any, and an interview. The all-round scientist had disappeared; concentration on a definite field was necessary.

Properties of Materials

Constructional improvements and refinements in the predetermination of performance had enabled numerous advances to be made, but progress must eventually become increasingly difficult unless parallel betterment of the properties of materials could be achieved. The studying of the properties of materials in terms of their atomic structure was necessarily of a speculative character and many of the conclusions reached were admittedly tentative and incomplete. But major future developments might well be along these lines, since in many instances the more empirical methods offered no guidance to the direction in which further research should proceed.

Referring to the investigations and theories of many workers, Mr. Churcher said that, unlike the case of the magnetic permeability of certain alloys, so far as was known, no alloy had been produced which had a higher conductivity than that of any of its constituents. Semi-conductors, or materials having resistivities intermediate between those of metals and dielectrics, possessed exceptional properties. In recent years semi-conductors having non-linear current-voltage characteristics had found a number of applications.

A feature of the present position in respect of magnetic materials was the large discrepancy between the magnetic properties obtainable in the laboratory and those available commercially. While much in fundamental theory was at present tentative or obscure, progress in this direction might be hoped to lead to the fuller understanding which was necessary to the narrowing down of those discrepancies, as well as to a more logical basis for the development of new materials.

A large part of the work of the research organisation of a manufacturing firm naturally consisted of investigations into specific problems in connection with established products. A typical example was the switchgear problem of devising means for recording the recovery voltage at any desired point on a live network without disturbance to the supply, on which a paper would shortly appear.

Measurement of Noise

Noise abatement, the branch of acoustics with which power engineers were mostly concerned, had two aspects; the objective dealt with the physical causes, and the subjective with the sensations evoked. If it were not for the subjective aspect, there would be no problem or science of acoustics. Yet it had been greatly neglected and many physicists considered this aspect to be outside their province. Indeed, one view was that sensations, such as loudness, could not be measured at all. An even more formidable and very practical question was whether there was any distinction between the loudness of a sound and the nuisance or annoyance it created and, if so, how the distinction was to be assessed.

Having secured a standard of reference, the next task was the devising of convenient portable meters which indicated by means of a pointer reading the equivalent loudness, in phons, of any noise it was desired to measure. The great difficulty was the enormous range and complexity of the noises met with in practice. Although it was by no means completely solved, progress had been made recently by investigators in this country and an objective meter, the development of which was finished last year by two of Mr. Churchill's colleagues, was to be described shortly before the Institution.

The technical side of purchasing specifications for materials and the acceptance testing of incoming consignments might be supervised by the research organisation. Data accumulated from the centralised technical control of materials were often of value in deciding the direction in which research on new materials should proceed.

The essence of research was not in the visible accompaniments, but in the imaginative and critical thinking which guided an investigation. In maintaining a due proportion of original research in advance of immediate practical needs, an industrial research organisation was performing its chief function and might be regarded as part of a continuous process. The knowledge derived from it was cumulative and subject to continual revision. Its value was not alone in the new products it might make possible, but also in the amplifying and clarifying of knowledge applicable to existing products. It also provided a foundation for future advances.

REPRESENTATION OF A.C. POWER

Employment of the Vector Method

By T. F. Wall, D.Sc.

IF an alternating p.d. is varying sinusoidally with the time and has a peak value V_m, the magnitude of the p.d. at any moment t may be represented by the expression, $v = V_m \cos(\omega t + \phi_1)$ where $\omega = 2\pi f$ and is the circular frequency. Similarly, if an alternating current is varying sinusoidally with the time and has the peak value I_m, the value at any moment t will be given by the expression,

$$i = I_m \cos(\omega t + \phi_2).$$

Such sinusoidally varying quantities may be represented by the projection on the real axis of the vectors OA and OB respectively, as shown in fig. 1, each of these vectors being assumed to rotate with the uniform velocity of ω radians per second. The vectors are shown in fig. 1 in the position which corresponds to the moment $t = 0$. The same result may be expressed by saying that the sinusoidally varying quantities can be represented by the component along the "real" axis Ox of the respective vectors,*

$$\mathbf{V} = V_m e^{j(\omega t + \phi_1)}\ ;\ \mathbf{I}\, I_m e^{j(\omega t + \phi_2)}.$$

Now if the product of these two vector expressions be taken, the result is given by the quantity

$$\mathbf{V}\cdot\mathbf{I} = V_m \cdot I_m e^{j(2\omega t + \phi_1 + \phi_2)} \quad .. \quad .. \quad .. \quad .. \quad (1)$$

and this is a vector of magnitude $V_m \cdot I_m$ which rotates at a uniform speed of 2ω radians per second, the component along the real axis Ox at any moment t being $V_m \cdot I_m \cos(2\omega t + \phi_1 + \phi_2)$.

Power of an Alternating Current

In an AC circuit in which the instantaneous current is $i = I_m \cos(\omega t + \phi_2)$ and the instantaneous voltage is $v = V_m \cos(\omega t + \phi_1)$, the power at any moment t will be given by

$$w = v \cdot i = V \cdot I \cos\phi + V \cdot I \cos(2\omega t + \phi_1 + \phi_2) \quad .. \quad (2)$$

where V and I are respectively the RMS values of the voltage

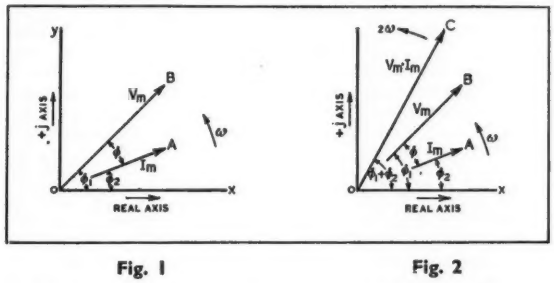

Fig. 1

Fig. 2

and the current waves and ϕ is the angle of phase displacement between the vectors $\mathbf{V_m}$ and $\mathbf{I_m}$ as shown in fig. 2.

In the expression (2) the quantity $V \cdot I \cos\phi$ is the mean value of the power and is the power which is measured by a wattmeter connected in the circuit. The quantity $V \cdot I \cos(2\omega t + \phi_1 + \phi_2)$ is a double frequency sinusoidally varying component of the total power in the circuit as shown in fig. 3 so that the power at any moment t is

$$\omega = v \cdot i = V \cdot I \cos\phi + \begin{cases}\text{the component, along the real axis of}\\ \text{the rotating vector } V \cdot I e^{j(2\omega t + \Phi_1 + \phi_2)}\end{cases}.$$

A comparison of the expressions (1) and (2) shows that the expression (1) gives no information as to the mean power in the circuit but only takes account of the fluctuating component, that is the double frequency sinusoidally varying portion of the total power.

For the investigation of many problems concerning the performance machines and apparatus it is equally important to take into account not only the active power $W_r = V \cdot I \cos\phi$ but also the reactive power $W_i = V \cdot I \sin\phi$ that is to say, to include the vector $\mathbf{W}$ of the total power, viz., $\mathbf{W} = W_r + jW_i$.

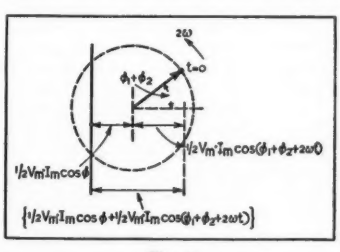

Fig. 3

For example, when a circuit comprises a resistance load in series with an inductance, the generator must be able to supply a reactive power component of the magnitude $W_i = V \cdot I \sin\phi$ in order that the active power $W_r = V \cdot I \cos\phi$ shall be delivered to the consumer and this reactive power will then determine the demagnetising effect of armature reaction which will be developed in the generator.

It is very desirable for these reasons to devise some means whereby the product of the vectors of voltage and current shall give the active as well as the reactive power that is to say shall give a vector of the magnitude $V \cdot I$ making an angle ϕ with the real axis so that $V \cdot I \cos\phi$ shall denote the active power and $V \cdot I \sin\phi$ the reactive power. Such a method will then facilitate the solution of problems in which it is necessary to examine the performance of machines and apparatus as influenced by the active power as well as the reactive power.

Vector Representation of Power

Referring now to figs. 4 and 5 in which the mean power, that is active power, is given by

$$W_r = V.I \cos\phi = V \,.\, I \cos(\phi_1 - \phi_2) = V_1 \,.\, I_1 + V_2 I_2.$$

The reactive power will then be,

$$W_i = V \cdot I \sin\phi = V \cdot I \sin(\phi_1 - \phi_2) = (V_1 I_2 - V_2 \cdot I_1)$$

so that the vector of the total power may be written

$$\mathbf{W} = W_r + jW_i = V_1 \cdot I_1 + j(V_1 \cdot I_2 - V_2 \cdot I_1) \quad .. \quad .. \quad .. \quad (5)$$

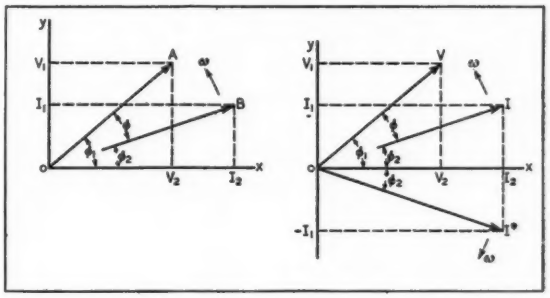

Fig. 4 Fig. 5

Now suppose that the vector product $\mathbf{V}\cdot\mathbf{I}^*$ is taken, where $\mathbf{I}^* = Ie^{j(-\omega t - \phi_2)}$. That is to say, the vector $\mathbf{I}^*$ is conjugate to the vector $\mathbf{I}$ with respect to the real axis Ox so that it will rotate in the opposite direction to $\mathbf{I}$ or, in other words, the vector $\mathbf{I}^*$ is the image of the vector $\mathbf{I}$ in the real axis Ox as is shown in fig. 5. Hence $\mathbf{I}^* = I_2 - jI_1$ and the product of $\mathbf{V}$ and $\mathbf{I}^*$ then becomes

$$\mathbf{V}\cdot\mathbf{I}^* = V \cdot e^{j(\omega t + \phi_1)}\, I \cdot e^{-j(\omega t + \phi_2)} = V \cdot I e^{j(\phi_1 - \phi_2)}$$
$$= V \cdot I \cos(\phi_1 - \phi_2) + jV \cdot I \sin(\phi_1 - \phi_2) \,.. \quad (6),$$

that is, $\mathbf{V}\cdot\mathbf{I}^* = V_1 \cdot I_1 + V_2 \cdot I_2 + j(V_1 \cdot I_2 - V_2 \cdot I_1)$

which is identical with the expression (5). It is seen therefore that by taking the vector product $\mathbf{V}\cdot\mathbf{I}^*$ the result gives both the active power and the reactive power in the circuit.

It is to be observed that in the foregoing investigation a *lagging current* gives *positive reactive power* since, in fig. 4, ϕ_1 is greater than ϕ_2 so that, $W_i = V \cdot I \sin(\phi_1 - \phi_2)$ is positive. It is, of course, a purely arbitrary matter whether reactive power corresponding to a lagging current is taken to be positive and that corresponding to a leading current is taken to be negative or vice-versa. It is, however, more commonly the practice to express the reactive power which corresponds to a *leading current* as *positive* and it is easily shown by similar considerations to those dealt with and illustrated that in fig. 5 this will be the case if the power vector is written $\mathbf{W} = \mathbf{V}^* \cdot \mathbf{I}$ where the vector $\mathbf{V}^*$† is conjugate to the vector $\mathbf{V}$ with respect to the real axis Ox.

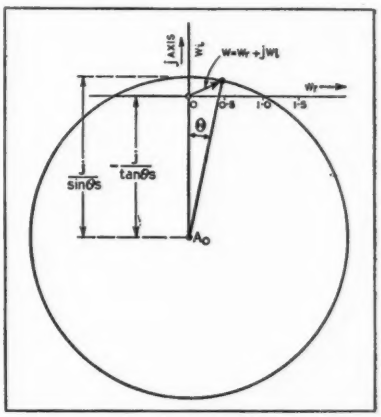

Fig. 6

Example.—An important practical application of this method for representing AC power is the case of the Circle Diagram for a long distance transmission line. In a previous article* it was found that for a "no loss" transmission line, the equations defining the relationships between the vectors of pressure and current at each end of the line may be written,

$$\mathbf{V}_1 = \mathbf{V}_2 \cos\theta S + Z_0 \mathbf{I}_2 j \sin\theta S \quad .. \quad .. \quad .. \quad .. \quad (7)$$

$$\mathbf{I}_1 = \mathbf{I}_2 \cos\theta S + \frac{1}{Z_0}\mathbf{V}_2 j \sin\theta S \quad .. \quad .. \quad .. \quad .. \quad (8)$$

*Vector quantities are printed in heavy type.

† Voltage Stabilisation, ELECTRICAL REVIEW, March 29th, 1940.

where S kilometres is the length of the transmission line,

$$\theta = \frac{2\pi f}{3 \cdot 10^5}$$

$$Z_0 = \sqrt{\frac{l}{c}}$$ and is the surge impedance of the line.

Assuming that the voltage at each end of the line is maintained constant and of equal magnitude, so that $V_1 = V_2$, where V_1 refers to the generator end of the line and V_2 refers to the consumer's end of the line. Then if $\mathbf{V}_1$ is taken as the datum vector so that $\mathbf{V}_1 = V_1$, the vector for the voltage at the consumer's end of the line may be written $\mathbf{V}_2 = V_1 \cdot e^{-j\Theta}$ where Θ is the angular displacement between the two voltage vectors $\mathbf{V}_1$ and $\mathbf{V}_2$. Eliminating the vector $\mathbf{I}_2$ between the simultaneous equations (7) and (8) it is easily shown that

$$\mathbf{I}_1 = \frac{V_1}{Z_0}\left\{ -\frac{j}{\tan \theta S} + \frac{j}{\sin \theta S} e^{-j\Theta} \right\}$$

The power supplied by the generator will then be given by the expression, $\mathbf{W} = \mathbf{V}_1 \mathbf{I}_1^* = V_1 \mathbf{I}_1^*$ since $\mathbf{V}_1$ has been taken as the datum vector and is therefore fixed in the direction of the real axis. Hence,

$$\mathbf{W} = \frac{V_1^2}{Z_0}\left\{ -\frac{j}{\tan \theta S} + \frac{j}{\sin \theta S} e^{-j\Theta} \right\}$$

in which $\frac{V_1^2}{Z_0}$ is the natural power per phase W_n of the line as has already been defined in the previous article.*

* ELECTRICAL REVIEW, *loc. cit.*

Dividing each side of equation (9) by W_n gives,

$$\frac{\mathbf{W}}{W_n} = w_r + jw_i = \left[-\frac{j}{\tan \theta S} + \frac{j}{\sin \theta S} e^{-j\Theta} \right] \quad .. \quad (10)$$

This expression represents a Circle of which the centre A_0 lies on the vertical co-ordinate axis (that is, the j axis) and at a distance $\frac{1}{\tan \theta S}$ below the origin. This Circle is shown in fig. 6 and it will be seen that it crosses the horizontal axis (that is, the real axis) at the value $w_r = 1$, that is to say, for the condition that the line is transmitting its natural power; for this condition no reactive power will be supplied by the generator. For loads which are less than the natural load, positive reactive power must be supplied by the generator, that is, the current will be leading on the terminal voltage, whilst for loads which are greater than the natural load the generator must supply negative reactive power, that is to say, the current will be lagging on the terminal pressure.

If the general simultaneous equations (7) and (8) are extended to include the line and insulation resistances the corresponding circle diagram can be obtained by the same general procedure as has been explained in the foregoing. The effect of inequality of the voltage at the two ends of the line is also easily taken into account.

There are many other applications of this method of vector representation of AC power and this treatment leads not only to a notable simplification of such problems, but also provides a comprehensive and easily interpreted survey of the solutions so obtained.

POWER PROJECTS IN EIRE

(From our Dublin Correspondent)

A BILL, the main purpose of which is to provide an additional loan of £4,000,000 from the Irish Exchequer to meet the capital requirements of the Electricity Supply Board up to March, 1942, passed its second stage in the Dail recently.

Former legislation limited these advances to £6,259,000, and the further sum which the Electricity (Supply) (Amendment) Bill, 1940, seeks to make available to the Board includes £800,000 for a peat-fuelled generating station at Clonsast Bog, near Portarlington, Co. Leix; £60,100 to increase the transformer capacity at Ardnacrusha; £244,000 for an additional 20,000-kW set, the modernisation of switchgear and other improvements at the Pigeon House power station, Dublin; £486,000 for a new 110-kV transmission system, including the construction of lines from Dublin to Cork via Waterford and Carrick-on-Shannon to Dundalk, together with substations at Waterford and Dundalk; £277,000 for a 38-kV system; and £31,000 for a 10-kV system, including the strengthening of existing mains to deal with increased loads.

High- and low-voltage distribution requirements are calculated at £361,000, while mains extensions to consumers (based on the normal rate of growth) are estimated at £274,000, with £269,000 for services and meters, £66,000 for hire schemes and £20,000 for public lighting. Estimates for new areas, including the provision of supply and the purchase of existing undertakings, amount to £98,000; £75,000 is needed for new buildings and improvements, £33,000 for compensation under the Shannon Fisheries Act, and there is a sum of £362,650 for contingencies.

Increased Liffey Expenditure

Owing to the increase in the size of the generating plant originally budgeted for in the Liffey hydro-electric scheme and abnormal market conditions further capital provision of £280,000 is provided for in the Bill. The cost of the dam has risen by £88,400 to £320,450, that of the various new bridges by £79,000 to £110,190, and the cost of the mechanical equipment of the dam by £19,650 to £38,190.

In introducing the Bill Mr. MacEntee, Minister for Industry and Commerce, revealed that the development of the Clonsast Bog would involve a minimum expenditure of £1,000,000. He said it was estimated that the bog had a productive life of at least twenty-five years, and there were adjacent bogs which could be exploited to extend the life of the industry by at least another quarter of a century. The ultimate value of the investment in the Portarlington station depended upon the measure of success which attended the endeavours of the Turf Development Board to solve the engineering and other very difficult problems involved in winning at least 120,000 tons of fuel annually from the bog, for unless the generating station were erected to utilise this amount the bog could not be made an economic proposition. One of the special difficulties, due to the war, was that of obtaining the turf-winning plant. Six machines which were on order would have given the required output, but only three could now be obtained. The Board was, however, trying to get the other three constructed at home. He added the assurance that delay in securing the other machines would not mean that the project would collapse.

Having envisaged measures to be taken in certain eventualities, the Minister went on to say that they had now reached the stage where they must consider new projects, apart from those at Portarlington and Poulaphouca (River Liffey). It was clear that the most important river from a hydro-electric point of view, excluding the Shannon, was the Erne. It was estimated that 160-200 million kWh could be obtained annually from this source. It was possible to carry out the development of the river concomitant with the regulation of the lakes not only for the production of power but for the improvement of drainage. For this purpose the co-operation of the Northern Ireland authorities would be essential and, indeed, would be warmly welcomed. The development could be carried out very economically. (The river has a catchment area of about 1,600 sq. miles, rather more than half of which lies within Eire and the remainder in Northern Ireland.)

Following the Minister's statement in the Dail, the Dublin Press reported that the suggestion that the Northern Ireland authorities should co-operate in the River Erne scheme "had been most favourably received in the Six Counties."

Electricity in Mines

A REVIEW of the development of electricity in the mines during the past 30 years was given by Captain H. E. B. Daniell, delivering his presidential address before the North of England Branch of the Association of Mining Electrical Engineers at Newcastle-on-Tyne. Captain Daniell discussed whether it would be best to electrify all surface plant at collieries completely and came to the conclusion that all machines constantly running should be electrified but certain others should not. Compulsory examinations for mining electrical engineers, he said, were a boon, but there was the risk that the study of books would prevent the full study of practical matters.

In his inaugural address at Cardiff on October 12th as president of the South Wales Branch of the Association of Mining Electrical Engineers, Mr. C. C. Bleach (managing director, Concordia Electric Safety Lamp Co., Ltd.) spoke of the discovery of coal and its earlier uses. He pointed out that, unlike other commodities, the price of coal began to rise with increasing consumption, which fact, together with the fear of the supply of coal failing, caused scientists to consider alternative sources of power and methods of economising in the consumption of coal for power purposes. The 1913 output of coal in Great Britain of 287.35 million tons had in 1938 fallen to 227.02 million tons.

Figures of consumption of coal showed that in 1913 electricity undertakings used 4.9 million tons and that in 1938 this figure had reached 14.93 million tons. In the same period gas works had increased their requirements from 16.7 to 18.2 million tons. Blast furnace consumption in the same period dropped from 21.2 to 11.56 million tons.

LIGHTING TERMINOLOGY

Need for Accuracy to Avoid Confusion

By Howard Long, M.I.E.E., F.I.E.S.

WITH the ever widening interest in lighting, which at the present time is being greatly accentuated by Government requirements of good lighting in factories, a clear appreciation of the correct terminology will avoid much confusion. There are some who adopt the attitude that "A rose by any other name would smell as sweet," but accuracy in technique involves accuracy in terminology.

The LUMEN is the amount of luminous flux emitted in unit solid angle by a uniform point source of one candle. If we consider an orange with sections in the form of pyramids with their apices at the centre and their bases at the skin, this will give a clear conception of solid angles. There are 12.57 such solid angles or pyramids in a sphere. Hence one candle produces 12.57 lumens. Electric lamps have their light output rated in lumens.

In these notes it is not intended to deal with all the terms used in connection with illumination and photometry—many of which are mainly of academic interest—but rather with those in common usage. Similarly, the phraseology and definitions used are intended to be in the popular and practical, rather than the academic style.

"Intensity" and "Amount"

CANDLE-POWER is the expression—in candles—of the luminous intensity, or luminous flux, per unit solid angle emitted by a point source in a given direction. In other words, candle power is a measure of the intensity of luminous flux emitted by the source in a given direction as distinct from the amount of luminous flux measured in lumens. Clearly, therefore, intensity is officially associated with candle-power and should not be used in connection with illumination.

The CANDLE is the basic unit of intensity arrived at by agreement between the national laboratories of several countries. At present it is an arbitrary standard. A new unit based on the solidification temperature of platinum has been agreed upon, but the war has prevented its coming into force.*

Reverting to our orange; each solid angle forms the boundary of approximately a square of unit area on the surface. ILLUMINATION is the luminous flux reaching the unit area on the surface or a measure of flux density. Although not absolutely so, there is some similarity between this and the magnetic system where flux and flux density are met. Those previously familiar with the magnetic system sometimes find this similarity of considerable assistance in understanding the units of lighting.

Here again we see that it is not flux intensity but flux density and therefore, the term "intensity" should not be used in connection with illumination.

The unit of illumination used generally in English-speaking countries is the FOOT-CANDLE—still considering our orange, one foot-candle will be the illumination on the surface or inside of the skin, if the source is one candle and the radius, or distance from centre to skin, is one foot. (Some orange!)

Remembering that for each pyramid or unit solid angle there is one lumen of flux, it is clear that one foot-candle is equal to a flux density of one lumen per square foot. Thus, if we know the total lumens falling on an area and the number of square feet therein, we can obtain the illumination in foot-candles by dividing the lumens by the square feet.

In this country, BRIGHTNESS is usually expressed in candles per square inch and is applied both to sources emitting light and surfaces reflecting light.

Incorrect Use of "Efficiency"

EFFICIENCY is defined in the British Standard Glossary† as "the ratio of the total luminous flux emitted to the total power consumed. In the case of an electric lamp it is expressed in lumens per watt." Sometimes the "efficiency" of a fitting is referred to, but this is incorrect as 100 per cent. efficiency entails the use of no fitting at all.

LIGHT OUTPUT RATIO is the correct term now used in connection with fittings. It is determined by measuring the total light output of the bare lamp and a further reading of the output of the lamp and fitting together. The latter reading is divided by the former and the result is the light output ratio. Most conveniently the measurements are made with an integrating photometer.

Light output ratios are only comparable for similar fittings. Take the standard industrial dispersive reflector, for instance, as compared with a distributing type. Although the former obviates direct glare and is more effective in providing light on the working plane, the latter, owing to the fact that it is less deep, will have a higher light output ratio.

DIFFUSION (per cent. of a lighting installation) is a measure of the amount of light which will reach the work with the machinery and worker in position as compared with the amount which would be received were there no obstruction. It is measured by taking a reading of the illumination on the work without obstructions, E, and another reading with obstructions, Ei. Then diffustion per cent. equals $\frac{Ei}{E} \times 100$. Obviously the higher this figure is the greater the utilisation of the light provided by the installation and the lower the waste of light.

Mr. H. Long

UTILISATION (COEFFICIENT OF) is the amount of light which reaches the unobstructed working plane as compared with the amount of light produced by the lamps. Clear thinking is necessary to obviate confusion with the foregoing factor "diffusion." If all the light from the lamps reached the plane of work and there was no loss in the fittings and on the walls and ceilings, the coefficient of utilisation would be unity. The coefficient is declared—in lighting handbooks—for various fittings under several conditions (height, size and shape of room) and used in calculating the illumination which will be obtained thus:—

$$\left.\begin{array}{l}\text{Illumination (average over horizontal plane of work unobstructed)}\end{array}\right\} = E$$

$$= \frac{\text{Lumens output per lamp}}{\text{Area of floor space per lamp (square feet)}} \times \text{Coefficient of Utilisation}$$

To take into account the diffusion this figure of E should be further multiplied by the diffusion factor $\frac{Ei}{E}$ but there are no published data to predetermine the appropriate figure, which is only known to those with considerable experience.

UNIFORMITY RATIO is the ratio of the minimum illumination to the maximum illumination over a given plane. This ratio should be as high as possible after having taken all the factors for good seeing conditions into consideration. In a well planned industrial or office lighting installation a figure of 70 per cent. or higher should be obtained.

Types of Lighting

DIRECT LIGHTING means that not less than 90 per cent. of the total light output of the fitting is in the lower hemisphere; SEMI-DIRECT LIGHTING, that more than 60 per cent. and less than 90 per cent. of the total light output of the fitting is in the lower hemisphere; GENERAL LIGHTING, that not less than 40 per cent. nor more than 60 per cent. of the total light output of the fitting is in either hemisphere; SEMI-INDIRECT LIGHTING, that more than 60 per cent. and less than 90 per cent. of the total light output of the fitting is in the upper hemisphere; and INDIRECT LIGHTING, that not less than 90 per cent. of the total light output of the fitting is in the upper hemisphere.

The term GENERAL LIGHTING is also used to describe a lighting installation in which a uniform spacing of fittings—mounted at adequate height—is employed to provide uniform illumination over the unobstructed plane of work. LOCALISED GENERAL LIGHTING means a lighting installation in which the general layout—previously described—is modified so that the lighting fittings are arranged with due regard to the positions of the work and plant.

WORKING PLANE, or plane of work, is a plane of reference for illumination calculations and—unless otherwise specified—is a horizontal plane 3 feet above the floor in factories and 2 feet 6 inches above the floor in offices.

The MOUNTING HEIGHT of fittings in an installation, is the vertical distance between the working plane and the light centre of the source. (The filament in the case of an electric lamp.) The maximum mounting height available in a factory is the vertical distance between the floor and the ceiling—or roof truss when fittings are to be mounted thereon—less 4 feet. The 4 feet are made up of the height of the working

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* "The New Unit of Light," J. W. T. Walsh, "Transactions" of the Illuminating Engineering Society, London. Vol. V, No. 7, August, 1940. "Measuring Light," J. W. T. Walsh, ELECTRICAL REVIEW, September 8th, 1939.

† British Standard Glossary of Terms used in Illumination and Photometry, No. 233, 1932.

plane (3 feet) plus 1 foot, being the vertical distance between the top of the fitting and the light centre in the average case.

SPACING-HEIGHT RATIO is a term applied to lighting fittings to indicate the maximum spacing which may be adopted with a given mounting height. Exceeding this ratio will result in non-uniformity of illumination. On the other hand, any closer spacing can be adopted with advantage, resulting in greater uniformity of illumination and higher percentage diffusion.

ANGLE OF CUT-OFF.—To reduce direct glare from the lamps an opaque screen between the filament and the line of vision is desirable. Usually this screen is part of the reflector. The angle of cut-off is the greatest angle below the horizontal at which the filament cannot be seen. In other words the angle between the horizontal and a line between the eye, the lower edge of the reflector and the lower edge of the far side of the filament.

In this respect the Fifth Report of the Departmental Committee on Lighting in Factories (H.M. Stationery Office, 1940, 3d. net) reads, "Where any light source in a factory is less than 16 feet high above floor level, no part of the source or fitting having a brightness greater than 10 candles per square inch shall be visible to any person whilst normally employed within 100 feet of the source, unless the angle of elevation from the eye to the source exceeds 20°."

Reflection

REFLECTION FACTOR.—The ratio of the total amount of reflected light from a surface, to the amount of light falling on the surface. The simplest way of obtaining an accurate figure for a given surface is by placing a specimen over a small aperture in a special sphere and comparing the reading with that obtained when the standard comparison surface is in the same position.

REGULAR REFLECTION FACTOR.—Frequently this is referred to as specular reflection factor. Regular reflection is best understood by considering a flat mirror with a pin perpendicular to the surface. Assume a beam of light is thrown on to the mirror on one side of the pin, then the beam is reflected from the mirror in the same plane and at the same angle between the reflected beam and the pin, as between the incident beam and the pin. All the light may not be reflected at this angle if the mirror is not very flat and very clean. The regular reflection factor is then a measure of the amount of light regularly reflected in proportion to the amount incident. Regular reflection is made use of in silvered glass, prismatic glass and polished metal reflectors when a controlled beam of light is required.

DIFFUSE REFLECTION FACTOR.—Considering the previous case, but with a sheet of blotting paper in place of the mirror, the whole of the incident beam is split up and leaves the surface in all directions as if a pea were on the surface, some going back to where it came from. This is diffuse reflection. Diffuse reflection factor is similarly the amount of light diffusely reflected as compared with the amount incident.

MIXED REFLECTION.—Now substituting a piece of vitreous enamelled steel in place of the blotting paper or mirror we find that most of the light is diffusely reflected but a little is regularly reflected. This principle is made use of in industrial reflectors, which—when properly designed—have good light control while avoiding the hard light from specular reflectors. Glare from images reflected from the work is also minimised.

SUPPLEMENTARY LIGHTING.—In a general, or localised general, lighting installation there are frequently working positions which require special treatment, either to provide more light for the visual task or a directional effect, special colour quality, &c. These effects—supplementary to the general lighting—are provided by special equipment which frequently is located at the same height as the general lighting equipment. In early days the term "local lighting" was used but "supplementary lighting" is now more appropriate.

LOCAL LIGHTING.—A system of lighting where the light sources are adjacent to the work. This should always be used in conjunction with general lighting and hence this term is now redundant.

Visual Task and Size

VISUAL TASK.—In the new technique of lighting for seeing it is first necessary to study what has to be seen—the visual task—how it is seen and how best to enable this with artificial light. The various and several factors which have to be studied when analysing the visual task have been dealt with fully in a previous article by this author.*

VISUAL SIZE.—The size in minutes of arc which the task subtends at the eye. It is important to understand that the size concerned is not that of the complete object to be seen, but the size of the smallest detail thereon which permits visual discrimination.

TERMS AND SYMBOLS

Term	Symbol	Unit	Abbreviation	Equation
Luminous flux ...	F	Lumen	*l*	—
Luminous intensity ...	I	Candle	c	—
Illumination	E	Foot-candle	Ft-C	$\frac{I}{s}$
Area	S	Square Foot	—	—
Brightness	B	Candle per square inch	c/in^2 or $c/\square''$	—
Efficiency	η	Lumen per watt	l/w	—
Diffusion	D	Per cent. ratio	—	$\frac{Ei}{E} \times 100$
Utilisation (coefficient of)	μ	—	—	$\frac{E \times S}{l}$
Uniformity	U	Per cent. ratio	—	$\frac{Emin}{Emax} \times 100$
Reflection factor ...	ρ	—	—	—
Transmission factor ...	τ	—	—	—

The order in which the terms appear in the table is roughly in their order of importance and frequency of usage rather than their technical relative association.

* "Planned Lighting for 'Seeing.'" ELEC. REV., November 10th, 1939.

NEW BOOKS

Introducing Radio Receiver Servicing. By E. M. Squire. Pp. 97; figs. 106. Sir Isaac Pitman & Sons, Ltd., 39, Parker Street, London, W.C.2. Price 6s.

One effect of the war on the retail side of the radio industry has been the calling up of large numbers of trained service engineers. The result is that to a large extent their places are being taken by young men who are having to learn the technical side of the business under rather difficult conditions. There are already a number of excellent manuals available on the subject of radio servicing, but very few of them are written for the benefit of the complete novice, or if they are, they usually deal at length with elementary theory and do not lead up well to practical work.

The book under review is a welcome exception, and its author is obviously well aware of the type of information the beginner needs. As the title indicates, and as the author stresses in his preface, the book is intended to act as an introduction to the subject which will place novices in a position to read more advanced treatises after having covered the groundwork without too great a demand on their time. Nevertheless, the book contains much information of which many practising engineers will probably be ignorant.

After a brief introduction the author gives a general survey of radio receivers and then deals in some detail with the principal components with which the engineer must be familiar. The next chapter deals with valves and their operation, all modern types being covered with the possible exception of one or two rather specialised varieties.

The important subject of circuit diagrams and how to read them also has a chapter of its own, various circuits being split up into sections and dealt with in detail. A chapter on the radio-gramophone contains some useful information on the internal construction of pick-ups, and this is followed by an important section on servicing equipment and its use. The instruments are described in the correct order of importance, the more advanced types being only briefly covered.

The final short chapter on tackling the first service job stresses the most important point in connection with service work, namely, that systematic fault finding, rather than haphazard testing, should be the aim of all who are taking up this class of work. The book is well illustrated with line drawings and circuit diagrams, and can be thoroughly recommended to those for whom it has been written.—W. E. M.

Small Motor Construction. By J. Gordon Hall. Pp. 66; figs. 27. Percival Marshall & Co., Ltd., 60, Kingsway, London, W.C.2. Price 2s.

This is not a textbook. It treats of series-wound machines of the kind employed for driving domestic appliances and similar purposes. Assuming that certain parts of such machines have become standardised, the endeavour has been to describe in non-technical language the process of making motors. The author, wishing to be entirely practical, did not think that any good purpose would be served by entering into the theory of their design, naïvely remarking that many facts will become self-evident to the reader during the course of building and operating his first motor!—W. O. F.

How to Prevent Electrical Troubles. By E. B. Watton. Pp. 104; figs. 25. Percival Marshall & Co., Ltd., 60, Kingsway, London, W.C.2. Price 2s. 6d.

This book is offered to the "great brigade of practical electricians" who are not concerned with theory and formulæ, but need advice on simple maintenance and the rectification of common troubles. There are three chapters on generators and motors, one on batteries and two on switch and control gear, followed by one chapter each on transformers, domestic and portable appliances, insulating materials used in repair work, temporary repairs and salvage of plant after fire or floods.—W. O. F.

Shorter Notices

Power Factor Problems in Electricity Supply. By G. W. Stubbings. Pp. 174; figs. 35. E. & F. N. Spon, Ltd., 57, Haymarket, London, S.W.1. Price 8s. 6d.

Vibration in Machinery. By W. A. Tuplin. Pp. 111; figs. 26. Sir Isaac Pitman & Sons, Ltd., 39, Parker Street, W.C.2. Price 7s. 6d.

PERSONAL AND SOCIAL

Information regarding new appointments and other matters of interest for this page are welcomed

THE new chairman of the East Midlands Sub-Centre of the I.E.E., **Captain B. C. Bayley**, M.B.E., M.I.E.E., delivered his address entitled "The Rapid Growth of Electricity in Industry" at the opening meeting held at Loughborough College on October 12th.

Captain Bayley received his technical training at the Wolverhampton Technical School and studied under a civil engineer in London. He served his apprenticeship with the Electric Construction Co. and later joined the supply department of the B.T.H. Co. From 1915 to 1919 he served in the Royal Engineers, and after service in France he took charge of the workshops and plant at the headquarters of the London anti-aircraft defences.

Capt. B. C. Bayley

He returned to the B.T.H. Co. in 1919 and was posted to the contract department, where he handled a wide range of industrial and municipal contracts. During this period he was sent to the U.S.A. on a special mission in connection with a large steel rolling mill plant. In 1928 he resigned from the B.T.H. Co. to join the John Player & Sons branch of the Imperial Tobacco Co., Ltd., in which he now holds the post of chief electrical engineer. During the last twelve years the expansion of the electrical plant has been very extensive and under his direction an entirely new lay-out has been completed, comprising a main 6.6-kV distributing substation feeding six factory substations.

Mr. H. Muscroft, A.M.Inst.T., general manager of the Southend-on-Sea Corporation Transport Department, has been advised by the Corporation that he is at liberty to seek other employment during the war owing to the decline in traffic.

Sir Felix Pole, chairman of Associated Electrical Industries, Ltd., has been appointed a member of the Advisory Council to the Committee of the Privy Council for Scientific and Industrial Research.

Lord Hirst, chairman of the General Electric Co., Ltd., has made a personal investment of £20,000 in connection with the Birmingham War Weapons Campaign.

Mr. S. R. Wallis, sales manager of the Stirling Boiler Co., Ltd., retired on October 8th on a pension, after thirty-five years' service on the sales side of the company's business. His address is Arran House, 33, Winn Road, London, S.E.12.

Mr. E. L. Crabbe, assistant station superintendent at the old Strand power station of Swansea Corporation, has retired on superannuation, and has been presented by the staff of the Electricity Department with an armchair. Mr. Crabbe joined the Department thirty-seven years ago as foreman fitter.

Mr. H. Thomas, Pontardulais, has been elected president of the West Wales Branch of the Association of Mining Electrical Engineers.

Mr. T. W. Graves, A.M.I.E.E., a senior assistant (technical) in the Chief Engineer's Department of the London County Council, is retiring at the end of November. Mr. Graves reached the age of sixty-five in May last, but the Council retained his services until November 30th on the ground that his retirement on the due date would cause inconvenience to the public service. He has had thirty-seven years' service with the Council, the whole of which has been spent in the electrical division of the Department, and for some years he has been in charge of the section dealing with the testing of electricity meters.

Mr. H. L. Wickes has been appointed sales manager of Higgs Motors, Ltd., in the place of the late Mr. G. B. Richards. Mr. Wickes has been with the Company for the last fourteen years, occupying various positions in the sales organisation. Prior to that he served with the General Electric Co., Ltd.

Many readers will learn with regret of the decision to retire of **Mr. A. E. Duffy**, a member of the editorial staff of the *Electrician*. In the course of over fifty years' service with our contemporary (he joined it in 1884) he came into contact with representatives of all branches of the electrical industry. He had previously been associated for three years with the *Contract Journal*. We wish him many years of health and happiness in his well-earned retirement.

Mr. H. Ferguson, managing director of British Plaster Board, Ltd., has joined the board of A. C. Cossor, Ltd.

At the fourth annual conference of the New Zealand Federation of Electricians' Associations a resolution for the formation of the N.Z. Institute of Electricians, Inc., was carried unanimously, and **Mr. Martin Smith** (Hawera) was appointed first president.

Obituary

Mr. G. A. Crowson.—The death occurred recently of Mr. G. A. Crowson, manager and engineer of the Cambridge Electric Supply Co. Mr. Crowson served throughout the last war and afterwards was engaged with several of the associated undertakings of Edmundsons Electricity Corporation, Ltd. He served with the Wessex Electricity Co. at Newbury for eight years before going to Cambridge.

Mr. G. H. Nisbett, M.Eng., J.P.—We reported last week the death of Mr. George Hinde Nisbett, deputy-chairman of British Insulated Cables, Ltd., which occurred on October 21st at Liverpool.

After his training under Professors Ayrton and Perry and with Paterson & Cooper, Ltd., and a brief period as distribution engineer with the City of London Electric Lighting Co., Mr. Nisbett's real career began when he joined the British Insulated Wire Company as chief engineer in May, 1894. He developed the then new paper-insulated cable and applied it to the distribution of electricity with such results that, by 1896, the Company had built the first 11 kV lead-sheathed, paper-insulated cables in the world, and had in service the well-known concentric cable of that type for the London Electric Supply Corporation. This laid the firm foundation for the B.I.W.'s cable business which was developed under his guidance, while it provided a sure footing on which the Company expanded its activities in many directions, leading up to the establishment of the British Copper Refinery.

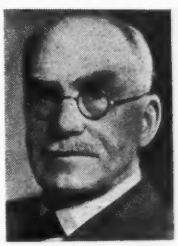
The late Mr. G. H. Nisbett

Mr. Nisbett's work for his Company was recognised by his promotion to the Works Management Committee in October, 1918, and to the board in March, 1924, and, subsequently, he became managing director, from which position he retired in May last owing to ill health, although he retained the vice-chairmanship of the board. He took a leading part in the formation of the C.M.A. and other associations, and he was the originator of the scheme which led to the collaboration of leading cable-makers under the name of Cable Research.

Mr. Nisbett was interested in technical education; he served for many years on the Advisory Committee of Engineers at Liverpool University and his work was recognised when the University conferred on him the honorary degree of Master of Engineering. He was extremely resourceful as a negotiator and carried through many agreements of first-class importance.

Mr. Nisbett had many interests in the electrical and allied industries, being chairman of Thomas Bolton & Sons, Ltd., the Boston & District Electric Supply Co., Ltd., the Colne Valley Electric Supply Co., Ltd., Electrical Facilities, Ltd., the Electrical Finance and Securities Co., Ltd., the Lothians Electric Power Co., Ltd., the Midland Electric Corporation for Power Distribution, Ltd., and the Northwood Electric Light & Power Co., Ltd. He was also a director of W. T. Glover & Co., Ltd., and British Copper Refiners, Ltd.

Mr. H. R. Forbes Mackay.—By the death of Mr. Hugh Rose Forbes Mackay, which occurred at Sydney (N.S.W.), on October 18th, Australia has lost one of its outstanding electricity supply engineers. Born in England, Mr. Forbes Mackay went to Australia in 1908 to take up the position of electrical engineer to the Municipal Council of Sydney and when the undertaking was transferred to the Sydney County Council he became general manager. He retired from that position in October last year and in February was appointed Chief Censor for Communications in New South Wales. During his thirty-one years' service with the Sydney undertaking remarkable progress was made and under his direction it became one of the most important electricity undertakings in Australia. In recognition of his contribution to engineering he was awarded the Peter Nicol Russell Memorial Medal in 1936 by the Australian Institution of Engineers. Before going to Australia Mr. Forbes Mackay was resident engineer for the London district, Engineer's Department, G.W. Railway.



The late Mr. H. R. Forbes Mackay

Mr. C. Lanceley.—The death occurred on October 19th, after some months' illness, of Mr. Charles Lanceley, chief of the Engineering and Contracts Department of Brookhirst Switchgear, Ltd.

Mr. George D. Tee.—The death is announced, at the age of 69, of Mr. George Drewitt Tee, of Worthing. He was a senior partner in the Worthing firm of electrical contractors, Tee Brothers, which he established in 1903, and he was treasurer of the local branch of the Electrical Contractors' Association. Mr. Tee leaves a widow, but no family.

I.E.E. Students

THE annual dance of the North-Eastern Students' Section of the I.E.E. will be held on November 8th at the Old Assembly Rooms, Newcastle-upon-Tyne. Tickets (4s. each) can be obtained from Mr. G. E. Topping, 40, Cartington Terrace, Newcastle-upon-Tyne, 6.

The opening meeting of the 1940–41 session of the Institution of Electrical Engineers North Midland Students' Section will be held tomorrow, Saturday, at the Hotel Metropole, Leeds, at 2.30 p.m., when Mr. S. R. Brown will present his chairman's address on "Carrier Telephony on Aerial Trunk Telephone Lines."

FORTY YEARS OF PROGRESS

Dr. Merz's Contributions to Technical Advance

WHILE the supply of electricity was established as a public utility well before the end of the last century, it was still regarded as a matter of local concern only and the generating station was generally known as the "electric light works." It was not until 1898 that Parliamentary powers were sought by an undertaking to provide electricity primarily for motive power for industry and to serve a district very much wider than that of a local government area.

This undertaking, which formed the nucleus of the present North-Eastern Electric Supply Co. was the first to distribute on the three-phase system at what was then considered a very high voltage, *viz.*, 6 kV. The scheme was officially inaugurated on Tyneside by Lord Kelvin. Within the next eight years it covered the whole of Northumberland and Durham and parts of Yorkshire, an area of 1,200 sq. miles. This involved the first use on any large scale of 20-kV underground cable and high-voltage overhead lines. The engineer for the company both in the promotion of the Bill and subsequently in executive control was Dr. Charles Merz (whose death we reported last week). His professional life, having been contemporary with modern developments in the practical application of electricity, possesses a wider significance than the purely personal aspect.

Turbo-Alternator Development

Neptune Bank power station on the Tyne, which was designed by him, was started up in 1900 and was the first to use large Parsons turbo-alternators. Comparative tests were made on these and the marine engines in the same station in deciding the type of prime mover to be used in the original *Mauretania* and the *Lusitania*. Three years later with the late Wm. McLellan, who became his partner, he designed Carville power station, the prototype of what were later to be popularly known as super-stations, and in 1904 he read a paper before the I.E.E. setting out the principles of power station construction. Waste heat from coke ovens and exhaust steam from blowing engines were also used for the production of electricity for general distribution in the same district. Problems involved in large-scale operation led to the evolution of many technical advances which are now common practice. Among these were balanced protection (*e.g.*, Merz-Price) centralised system control, turbine bleeding, inter-stage steam heating, closed feed-water systems and metal-clad switchgear.

In order to secure the necessary load a consumers' department was organised—a distinct novelty in those days. This load included collieries, iron and steel works, shipyards, electric furnaces for making silica and chemical works. The first large Ilgner sets to be constructed were connected to the company's network. In connection with this aspect of his work, Merz interested himself in improvements in distribution boxes, meters and switchgear and designed the original integrating maximum-demand attachment to the ordinary meter.

When Tyneside was first electrified there was no switchgear of any kind suitable for shipyards or outdoor use generally and in 1904 Merz suggested the development of ironclad switchgear to get over the difficulty of exposed high-voltage apparatus in confined spaces, the first of this type being erected in Carville. At about the same time he got the late H. F. Fullagar to start experiments on the gas turbine, small units of which were constructed.

Higher Steam Pressures

During the last war large scale experiments were carried out at Dunston-on-Tyne on low-temperature distillation of coal. Carville B station was built for a somewhat higher steam pressure (275 lb. per sq. in.) than had previously been employed in this country. This was followed towards the end of the war by North Tees station in which the steam pressure was 475 lb. per sq. in. and a feed-heating cycle with air heaters instead of economisers was incorporated. The outstanding feature of this station was, however, the introduction for the first time of reheating (originally suggested by Ferranti) which was subsequently adopted elsewhere, notably in the United States, where on the advice of Merz it was used at Crawford Avenue station, Chicago. The generating plant at the last named station included a Parsons 50,000-kW compound unit as a result of the successful operation of a 25,000-kW set of the same make exported to Chicago several years earlier. In the later State Line station was a 200,000-kW compound turbine, in the design of which Merz was also concerned as well as of other American stations involving the use of high steam pressures. Reheating was also used at Dunston B station, which came partly into use on the Tyne in 1933 and in 1938 headed the list of stations in overall thermal efficiency.

Other notable stations in Britain designed by Merz and his staff since the last war included those at Barking and Littlebrook (Kent) for the County of London Electric Supply Co. The former is the largest in the country, a total of 540,000 kW being installed on a site that was originally selected by Merz in 1905, when, encouraged by the low cost of production at Carville, he prepared a comprehensive scheme for the supply of London. The Bill embodying his proposals failed from lack of time to pass the House of Commons, but the scheme was revived in 1914 by the London County Council which engaged Merz as adviser, but the prolongation of the war caused the matter to be shelved once more.

In our obituary notice last week we referred to some of the larger Empire railway electrification schemes with which Merz was associated. His active interest in this field started in 1903 when he acted as engineer to the North-Eastern Railway for the electrification of its Tyneside track—one of the first two main-line railways in England to electrify any part of its system. The same company, at his instance, was the first British main-line railway (in 1916) to use electric locomotives, which were run between Shildon and Newport.

In 1907 Merz visited Australia to advise the Victorian Government regarding the extensive Melbourne Suburban Railways; this included the development of electric power from the large resources of brown coal eighty miles away. The scheme was finally adopted in 1912 and provided for the use of DC at 1,500 V from overhead lines. He then laid down the basis of the legislation and organisation for the control of the power industry in that State. For the two large suburban railways near Buenos Aires for which he drew up electrification plans in 1909, the DC system adopted used a special protected under-running third rail for 800 V. A visit to India in 1913 was followed by the electrification of suburban railways round Bombay and an extension of electrification of the main line over the Ghats for which 1,500-V locomotives were employed, power being derived from the Tata water-power undertaking supplemented by a steam station.

Immediately after the close of the last war he became responsible for the Natal scheme, the longest electrified section of main line railway in the Empire. The voltage was 3,000, as compared with 1,500 V for the Capetown suburban lines which he also converted. While in South Africa Merz prepared a report on the development and control of electricity throughout South Africa which led to the Act of 1922 and to the construction under his advice of large power stations on the Rand and in Capetown, Durban and other places.

Grid Proposals

A paper read before the British Association in 1916 laid down the principles of power station inter-connection and the organisation of generation on a comprehensive scale and evidence in similar vein was given before various Government committees to which we have referred elsewhere. As a result of a report put before the Electricity Commissioners in 1925, the Weir Committee was appointed and its recommendations formed the basis of the 1926 Act setting up the Central Electricity Board and providing for the construction of the grid. The last notable public duty he undertook was to serve as chairman of the International Commission appointed by the Egyptian Government in 1937 to report upon various proposals for utilising the water power available at the Assouan Dam. He was, however, known to have placed his experience at the disposal of the Government in an honorary capacity during the present war, as he did in the last, and he retained unabated interest in all that concerned his profession. At the outset of his presidential address to the Institution of Electrical Engineers last week, Mr. J. R. Beard, a partner in the firm of Merz and McLellan, mentioned that the views he had expressed were fully in accord with those of Dr. Merz.

I.E.E. (North-Western Centre)

IN view of the present conditions, the meetings of the North-Western Centre of the I.E.E. for the 1940-41 session will be held on Saturday afternoons at 2.30 p.m. at the Engineers' Club, Manchester, and the programme for the first half of the session is as follows:—November 16th: "The Limitation of Transformer Noise," by Messrs. B. A. G. Churcher and A. J. King. December 14th: "Practical Aspects of Earthing," (illustrated by a cinematograph film), by Messrs. E. Fawssett, H. W. Grimmitt, G. F. Shotter and H. G. Taylor. Mr. Churcher, chairman of the Centre, delivered his inaugural address on October 19th; an abstract of this appears on page 364 of this issue.

COMMERCIAL and INDUSTRIAL NEWS

Electricians for the Navy. Purchase Tax—Retailers' Position

Factory Management

A SILVER medal is to be awarded annually by the Institution of Factory Managers in honour of its first president, Sir Henry Fildes, Kt., M.P., for the best essay on some aspect of improved methods of factory management. Any factory manager in the British Empire is eligible and for this year essays (about 5,000 words) should be submitted not later than November 30th to the secretary of the Institution at Ashton New Hall, Ashton-on-Mersey, Chester.

Tin Metal and Alloys of Tin

In future licences to import tin metal and alloys containing more than 50 per cent. of tin will be issued on the advice of the Non-ferrous Metals Control. Accordingly applications for licences should be completed in duplicate (in accordance with the instructions given in "Notices to Importers" Nos. 57 and 70) and addressed to the Non-Ferrous Metals Control, Ministry of Supply, Grand Hotel, 46, Albert Street, Rugby, notwithstanding the direction at the top of the form that it should be sent to the Import Licensing Department. Forms of application may be obtained from the Import Licensing Department or the office of any Collector of H.M. Customs and Excise. Copies of "Notices to Importers" Nos. 57 and 70 may be obtained at the Import Licensing Department. Importers are reminded that there is an Open General Licence for the import of tin in blocks, slabs, ingots and bars from the British Empire, but not from Palestine, Hong Kong and Transjordan.

Canadian Battery Manufacture

During the first quarter of this year the Canadian battery business showed a remarkable increase. Compared with twelve months previously the manufacture of storage batteries rose by nearly 30 per cent. After a rise between 1938 and 1939 of about $300,000 in the annual value of sales at factory, the total during the first quarter of this year was $1,092,000 (compared with $844,000), which included the following:—Ignition batteries for i.c. engines, 180,832 (value $786,115); motor vehicle batteries, 722 ($2,366); cells for farm lighting plant, 4,596 ($24,951); and cells for railway lighting and signal service, 1,772 ($29,507). Imports of electric batteries of all kinds during the period under review were $121,900 in value compared with $67,700, and exports $195,200 against $66,100.

Purchase Tax on Inset Fires

The Commissioners of Customs and Excise have issued rulings upon the position of tiled fireplaces under the Purchase Tax. They announce that glazed and floor tiles, as such, are not taxable whether sold loose or slabbed in the form of panels, surrounds, curbs or hearths. Any form of domestic cooking or heating appliance which is sold by a registered manufacturer as a complete article, including slabbed tiling, therefore, is taxable as a whole, e.g., a fireplace or an electric radiator sold complete with slabbed tiling would be subject to tax on the wholesale price of the complete article.

Electrically Driven Canteen

Six months ago the Electrical Association for Women inaugurated a mobile welfare canteen service to operate among isolated units of the troops, bringing the amenities left behind in civil life. Working in conjunction with the War Office and the Y.M.C.A., the canteens met a present need, and to-day the fleet numbers eleven. During the past weeks the needs of the civilian population of London have become pressing, and at the request of the Minister of Food, the Association is lending to the London County Council an electrically propelled canteen which will help in the feeding of London's homeless at the rest centres. This, the first electrically driven canteen, was subscribed for in sixpences by members of the Association's 80 branches all over the country.

Designed by Mrs. W. Paterson (hon. organiser, E.A.W. mobile welfare canteen service) to combine that which is pleasing to the eye and practical in performance, it incorporates the original feature of a three-sided serving counter with accommodation for five or six people serving. A canopy can be pulled out in front to give shelter to an extra serving hatch. The canteen has a speed of 18 M.P.H. on the level, with an estimated operating range of fifty miles per charge. The chassis was presented by the Metropolitan-Vickers Electrical Co., Ltd., through the kindness of Sir Felix Pole, the charging equipment by the Westinghouse Brake and Signal Co., Ltd., and the battery by the D.P. Battery Co., Ltd. The Dowager Lady Swaythling, President of the E.A.W. presented the canteen to Mr. H. Berry, A.M.I.Mech.E., vice-chairman of the London County Council, on October 17th.

Limitation of Supplies

The Board of Trade has extended from October 30th to November 25th the period within which returns under the Limitation of Supplies (Miscellaneous) Order are required to be sent to the Assistant Secretary, Industrial Supplies (Registers) Department, Board of Trade, Fanum House, Whitcomb Street, London, W.C.2.

Australian Import Restrictions

The Commonwealth Government has reduced, as from October 1st, imports of a number of classes of goods from non-sterling countries and from Canada, Newfoundland and Hong Kong. Among the articles affected are the following:—Total restriction: Moulded household switches; high-tension ignition coils; and diagnostic X-ray units and parts. 75 per cent. restriction: Wireless receiving valves; and certain electrical and ignition parts for replacement purposes in motor vehicles. 50 per cent. restriction: Electric heating and cooking appliances, not elsewhere indicated; and electrical and gas appliances, n.e.i.

Maltese Import Duty Modifications

The Government of Malta has made a number of revisions of the Customs tariff affecting, *inter alia*, the following classes of goods:—Electrical goods, Empire preferential tariff 12 per cent. *ad valorem*, general tariff 26 per cent.; engines—electrical, steam (including boilers), oil, hot-air and marine, free under the Empire preferential tariff, 7 per cent. under the general tariff; and wireless sets and parts, 18 per cent. and 23 per cent.

Electro-magnetic Clock Centenary

The Edinburgh Electrical Society and the Royal Scottish Society of Arts intimate that the centenary of Alexander Bain's invention of the electro-magnetic clock, &c., will be appropriately celebrated next year. It has been ascertained that Bain had his workshop at No. 11, Hanover Street, Edinburgh, where he made electric clocks and telegraphs.

Contractors Aid Supply Engineers

At a recent meeting of the Liverpool Branch of the Electrical Contractors' Association it was reported that arrangements had been made with the city electrical engineer whereby members would supply labour for emergency repair work. Payment would be on the basis of 20 per cent. on cost. A representative gathering of the largest consumers in the city agreed that this was a fair rate of remuneration. It was subsequently reported that similar arrangements had been organised in Birkenhead. At Southport the arrangements were regarded as very satisfactory and further negotiations were stated to be in progress at Wallasey.

Manufacture of Electric Vehicles in Sweden

The ASEA Concern, in collaboration with the motor-car company Aktiebolaget Volvo, has started the manufacture of electric motor vehicles, especially lorries of about two tons, learns *Reuter's Trade Service* from Stockholm.

Upon full charge these vehicles can run about six hours at a speed of between 50 and 60 kilometres an hour.

Low Illumination Values

Referring to the article on this subject by Mr. G. H. Rawcliffe in our issue of October 18th, Holophane, Ltd., ask us to state that the word "Lumeter" employed by the author in a general way is their trade mark and therefore is not applicable to light meters generally.

Lengthening Cutting-tool Life

In view of the necessity for conserving steel and maintaining efficiency of production, the methods of treating cutting tools practised by Macrome, Ltd., are of interest. It is claimed that this treatment is not merely a form of case-hardening but affects the whole bulk of the steel. The principal advantages of the treatment are said to be a considerable saving in the setting-up time, grinding and handling of tools; increased production for the same tool consumption; and lower tool costs. The company's head office is at Hay Mills, Birmingham, and there are branches in London, Manchester and Glasgow.

Retailers and Purchase Tax

In the course of a statement to the Press last week, the chairman of the Central Price Regulation Committee (Mr. Raymond Evershed, K.C.) mentioned that the Purchase Tax was charged on the wholesale value of goods and was collected at the stage where the goods passed from the manufacturer or wholesaler to the retailer. The retailer would be entitled to recover the tax from the customer by adding it to the retail price. It was illegal, however, to add the tax to goods which were in stock on October 21st, the day on which the tax came into force, and the Committee would feel it necessary to ask for the imposition of the maximum penalties in cases where this was disregarded.

It was possible that the retailer might have in stock goods purchased both before and after this date in which case there would be two sets of prices. The Central Committee had considered the possibility of showing the price and tax separately but had come to the conclusion that this would be impracticable in many cases.

Electrical Naval Personnel

A category of electrical officers has been established in the Royal Naval Volunteer Reserve. These officers will be eligible for full pay on the scale laid down for qualified officers of the engineer category of the same rank and seniority.

The Admiralty announces that there are opportunities for men who have not yet attained registration age to enter the Royal Navy as wiremen for the duration of the war. Applicants are required to possess a knowledge of electric circuits and wiring. Particulars of conditions of service can be obtained from any combined recruiting centre the addresses of which are available at any Employment Exchange.

Patents in Enemy Countries

A statement made by the Patent Office regarding the renewal of patents held in enemy territory is quoted by *The Times*.

According to this, machinery exists for the purpose and fees in respect of patents, designs and trade marks held in enemy territory may be paid. There is a reciprocal arrangement with regard to patents held by Germans in this country. The renewal of patents and the payment of fees is left to the discretion of the patent holder, but though he pays the fees he cannot expect to receive royalties during the war. The Government hopes that arrangements for settling patent questions similar to those made after the last war will again be possible.

Conducting Tyres for Aircraft

In order to avoid risk of fire due to sparks from static electricity accumulated by air friction or during thunderstorms, aeroplanes must be earthed as soon as they land. This is best done through the use of electrically conducting tyres. The filler normally used in tyre treads is gas-black prepared by the incomplete combustion of natural gases which owing to its fine degree of sub-division (compared with lamp black derived from animal sources) possesses excellent reinforcing properties. Blacks free from non-conducting film without sacrifice of the normal properties of the material are now available, it is stated in *Plastics*.

Tyre treads of the conducting type are now being produced, it is claimed, with a minimum resistance of 30 ohms per cm^3, compared with the specific resistance of pure rubber of 1×10^{16} and of standard tyre tread of 1×10^9 ohm. The time required to discharge a large aeroplane with a conducting tyre has been found to be as little as 0.0001 sec. as against 20 to 30 min. generally necessary with a standard tyre.

Fatalities

An inquest was recently held at Swanage into the deaths of two men while engaged in aircraft salvage work at Studland. An employee, who was working with the two men stated in evidence that they were removing the wing of an airplane by means of a crane. The crane driver was told to move forward and as he did so the witness heard cries from the other side of the wing and saw flame and sparks. He then saw the two men lying on the ground and received a shock when he endeavoured to pull them clear. He had not noticed overhead wires in the field in which they were working.

The crane driver said that he had not been warned that there were power lines about. At the time of the accident it was twilight and he had his back to the crane arm which was at a height of 23 ft. Other witnesses said that there were warning notices on the poles and the wires were quite visible to anyone working in the field. A solicitor who appeared for the Bournemouth & Poole Electricity Supply Co., pointed out that the wires were at a greater height than the 20 ft. stipulated by regulations.

The Coroner returned a verdict of "Accidental death," saying that it was unfortunate that the gang had not noticed the poles and asked the supply company to cut off the power while they were working in the vicinity.

Aluminium Ware Banned

As from October 26th the supply by manufacturers and wholesalers of domestic hollow-ware made wholly or partly of aluminium is prohibited. Existing stocks may be directed to export but no further exportation of these goods will be possible upon the exhaustion of stocks.

Wages in the Contracting Industry

It is announced by the National Joint Industrial Council for the Electrical Contracting Industry that as from the second pay-day in November, for the period covered by that pay-day, the cost-of-living (war) addition to wages will be raised from 10s. 5d. to 11s. 8d. a week.

Cable Makers' Wages

The Joint Industrial Council for the Electrical Cable Making Industry announces that the cost-of-living figure on October 1st was 89 per cent. above the 1914 level. This will not involve any alteration in wages on the third pay-day in November.

Electricity for Sewage Treatment

Power costs for the treatment of sewage by the activated sludge process at the Withington works of the Manchester Corporation are given in the annual report of the Rivers Committee. The total volume of sewage treated was 510,670,000 gallons and 251,920 kWh was used. At the price of 0.681d. per kWh the cost per million gallons of sewage treated was £1 8s. 3d.

Changes of Address

The London offices of the Lincolnshire and Central Electric Supply Co., Ltd., and associated companies are now at 5, Moor Park Road, Northwood, Middlesex.

Communications to the British Electric Traction Co., Ltd., B.E.T. Electricity Supply Co., Ltd., and the Electrical Finance & Securities Co., Ltd., should be addressed to Dilton House, Pinkney's Green, Maidenhead, Berks.

Trade Announcements

Tenaplas, Ltd., states that its factory has been re-established in a new location and it is again producing "Tenawire," "Tenatube" and other material. Further plant is being installed in the new factory and production will be increased. Orders, inquiries and remittances should for the time being be sent to the company's head office at 36/37, Queen Street, London, E.C.4.

The Jackson Electric Stove Co., Ltd., announces that its office hours are now 9 a.m. until 5 p.m. from Monday to Friday (closing on Saturday).

The Wenham Lighting Corporation, Ltd., wholesale electrical factors inform us that they find it impossible to continue trading for the duration of the war and ask their customers to consider any outstanding orders as cancelled. They have transferred their organisation to an associated company, the Whitworth Electric Lamp Co., Ltd., 6-12, Gorleston Street, North End Road, West Kensington, W.14 (telephone: Shepherds Bush 1863). All correspondence in connection with outstanding accounts to October 31st should be sent to 32, West Drive, Harrow Weald, Middx. (telephone: Stanmore 826).

Multicore Solders

In the advertisement of Multicore Solders, Ltd., in our last issue the address of the Brownlee Bros., Ltd., factors stocking "Multicore," was incorrectly given. This should have read 102–3, Middle Abbey Street, Dublin.

New Catalogues and Lists

Metropolitan Electric Supplies, Metway Works, 2, Marshall Row, Brighton.—An illustrated and priced catalogue of wooden lighting fittings.

Siemens Electric Lamps & Supplies, Ltd., 38–39, Upper Thames Street, London, E.C.4. —An emergency lamp price list.

Harvey Frost & Co., Ltd., Bishop's Stortford, Herts.—Priced and illustrated leaflet descriptive of portable and workshop vulcanisers for jointing rubber cables.

Universal Winding Co., Saville Street, Oxford Road, Manchester, 1.—Illustrated leaflet dealing with the 5–19 style thread winding machine.

INFORMATION DEPARTMENT

GENERAL inquiries from readers relating to sources of electrical goods, makers' addresses, etc., are replied to by our Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

Our extensive records enable us to reply to most queries, but occasionally we ask for our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding the following:—

"562" pump head with 1/2 HP repulsion induction motor.

Electricity Supply (*concluded*).

paper, *Islam*. The company, it is stated, will be given a monopoly for the generation and supply of electricity throughout the country for 50 years.

Canada.—NEW TRANSMISSION LINE.—Construction, operation and maintenance of a single-circuit, three-phase, 220-kV transmission line from the terminal station at Three Rivers, Quebec, to the terminal at Quebec City is to be undertaken by the Shawinigan Water & Power Co., which has been authorised to do so by the Public Service Board. The new line is made necessary by an arrangement between the Shawinigan Co. and the Aluminium Co. of Canada. It is to be erected on steel towers and reinforced aluminium cables will be used.

OUTPUT EXPANDS.—Our Montreal correspondent reports that production of electric power in Canada increased by approximately 9 per cent. during the first half of this year, following a similar expansion in the calendar year 1939 when a new record was established for output. These figures are based on returns from the central electric station industry which produces electric power for sale. In addition there is a large productive capacity in the pulp and paper, mining and other industries. According to returns issued by the Dominion Bureau of Statistics, altogether 14,969 million kWh was produced at central electric stations in the first six months of this year against 13,744 million kWh in the corresponding period of 1939.

New war industries planned or contemplated in the Montreal area will absorb something like 280,000 HP of electrical energy. One inquiry alone to the Beauharnois Light, Heat & Power Co. calls for 100,000 HP.

Chile.—POWER PLANS.—The general electrification of Chile by harnessing all available energy in the principal rivers, one of the most important schemes sponsored by the Popular Front administration to supply cheap power to numerous industries, railways and towns, has received official support by the decision of the Trade Development Corporation to spend 133,000,000 pesos on a hydro-electric plant on the River Cachapoal, eighty miles south of the capital, learns *Reuter's Trade Service* from New York. The new plant, one of the largest in South America, will supply 85,000 HP to Rancagua and Santiago for delivery by subsidiary companies to industrial consumers and to the State railways for the electrification of the branch line from Santiago to the port of San Antonio. Power will also be distributed to farming districts. Other large hydro-electric schemes are being studied, including one at Huilo Huilo, near Valdivia, which is intended to supply the southern provinces.

RADIO AND TELEPHONY

Great Britain.—RADIO FOR POLICE AND FIRE SERVICES.—Blackpool Watch Committee is to provide a new wireless system for the police and fire services, comprising a radio station and 19 mobile transmitters and receivers.

RELAY STATISTICS.—At June 30th last there were 295,274 subscribers to 282 radio relay exchanges, compared with 279,377 subscribers to 281 exchanges at March 31st, an increase of 15,897 subscribers and one exchange.

Japan.—NEW SOUTH SEAS RADIO STATION. —TheKawachi transmitting station,Minami-Kawachi-gun, in the Osaka Prefecture, the proposed Osaka base for the international telephone service linking Batavia, Bangkok and Manila with Japan, is nearing completion. Commercial correspondence occupies 80 per cent. of Japan's South Seas communications, which have hitherto been solely conducted with Tokyo as the base. It has proved inadequate, however, and for that reason the new station has been built. The work started in September, 1939, but owing to raw material shortage is only now nearing completion. Transmission is expected to begin this month.

ELECTRICITY SUPPLY

Tubular Heaters for Croydon Shelters. Water Power in Chile

Ashton-under-Lyne.—WIRING OF AIR-RAID SHELTERS.—The wiring of 105 public and communal air-raid shelters for lighting from the mains, in accordance with B.S.S. ARP/6, is being carried out by the Electricity Department, and a further 225 are to be wired later.

TRAFFIC SIGNALS.—Approval has been received from the Ministry of Transport to a scheme prepared by the Electricity Department for the erection of "Russell" traffic signal masks. These permit the full signal face to be shown during daytime and the regulation cross at night, and are to be erected at all controlled crossings in the borough.

Birkenhead.—HIRE OF APPARATUS.—Sanction has been obtained to borrow £2,000 for consumers' electrical apparatus and the Electricity Committee is now applying for permission to borrow £5,000 in order that it may be able to continue the present facilities for the hire or hire-purchase of apparatus where the lack of such apparatus might cause hardship to consumers.

INSTALLATIONS IN SHELTERS.—The Corporation is to provide lighting in school shelters.

Bradford.—SUPPLY IMPROVEMENT.—The Electricity Committee has approved a revised scheme for the improvement of the supply to the Clayton area at a cost of £4,000.

Chester-le-Street. — ELECTRICITY PREFERRED.—The R.D.C. is being pressed to install electric light in shelters in place of suggested hurricane lamps.

Croydon.—TUBULAR HEATERS FOR SHELTERS.—A scheme for the provision of electric tubular heaters in public shelters recently came before the Emergency Committee. Estimates were submitted for 900 bays, averaging six lengths of tubing for each bay, with a total cost of £10,855. In view of the great demand at the present time for materials for this form of heating, the borough electrical engineer was authorised to place orders for the necessary equipment and proceed with the work as quickly as possible.

The Education Committee is to install electric lighting and heating in school shelters at a cost of £1,230.

SUBSTATIONS.—The Electricity Committee has obtained sanction to borrow £5,000 for substations and equipment.

Greenock.—SHELTER LIGHTING.—All public street shelters in Greenock are to be lighted by electricity.

Helensburgh. — STREET LIGHTING.—Proposals are to be submitted for a scheme of modified street lighting.

Hove.—UNDERTAKING'S OPERATIONS AND PROSPECTS.—During the war months up to the close of the last financial year there was a considerable influx of residents into the town, as well as several thousands of school-children, who remained until the early summer and helped to maintain the output of the electricity undertaking. Thus the total sales were 25.5 million kWh against 24.2 million kWh in the previous year, an increase of 9.5 per cent. Without any increase in charges—in fact the average price received decreased from 1.31d. to 1.25d. per kWh—there was a slight gain in revenue from the sale of electricity, and the total income rose from £135,906 to £137,109. Working costs were £93,295 (against £88,700) and there was a net profit on the year's working of £11,530 (£13,769). Fortunately, there was a reduction in the maximum load from 14,760 kW to 12,110 kW, due to the severe weather last winter occurring after the close of the calendar year, and the annual load factor improved from 22.6 to 27.57 per cent. Also, work on the change-over from DC to AC in the south-eastern area was well advanced at the outbreak of hostilities and was carried through to completion, together with other smaller schemes. As a result, transmission, conversion and distribution losses were reduced from 16.6 to 12.6 per cent. With regard to the future, the engineer and manager (Mr. F. Swarbrick) considers that although charges were advanced by 10 per cent. from the beginning of the current financial year, this will be insufficient to counteract the decrease in consumption unless there is some improvement in events during the coming winter.

In view of the satisfactory results, the Electricity Committee, which some months ago thought it was not possible to help the rates, now recommends a contribution of £3,968. In reply to a question at the last meeting of the Town Council, Alderman Nye (chairman of the Committee) said that this was the maximum they were allowed to make. With regard to the engineer's report, he said they had lost about 2,000 consumers since March, but the Committee hoped it would not be necessary to increase charges at the end of the present year.

Isle of Man.—ACTION DISMISSED.—The High Court action brought by the I.O.M. Electricity Board for a declaration of the rights and liabilities of the Board and Douglas Corporation under Section 9 of the Electric Light and Power Act, 1932, was dismissed by Deemster Farrant recently. He held that the questions in the plaintiff's claim were so involved in the ascertainment of the price between the two bodies that the whole of the matters in dispute, including the decision of the legal questions raised by the Board, were by the Statute bound to be submitted to arbitration, and that the jurisdiction of the Court was ousted. He therefore had no option but to dismiss the action, but as the matter was not, perhaps, so fully argued as counsel might have desired, he would not sign his judgment for a week, to give the parties an opportunity of further argument.

Lancashire.—"STARLIGHTING" PROGRESS.—Blackpool Corporation is extending the "starlight" system of illumination to the main arterial roads with satisfactory results. Burnley has 14,500 of these lamps and Accrington 387.

London. — LOANS. — The Electricity Commissioners have issued their consent to the borrowing of £100,305 by the J.E.A., including £55,809 for plant (substation equipment), fire protection apparatus and building work and £34,873 for mains.

MAINS EXTENSIONS.—The Finance Committee of the J.E.A. has approved estimates of capital expenditure for mains extensions, etc., amounting to £10,042.

ISLINGTON.—The Electricity Committee has obtained sanction to borrow £3,964 for switchgear and £19,000 for mains, services and meters.

FULHAM.—At a special meeting of the Borough Council recently negotiations for loans totalling £189,000 for electricity purposes were approved.

North Wales.—BULK SUPPLY TO LLANDUDNO.—Negotiations are proceeding for wayleave facilities in connection with the proposed 33-kV supply direct to Llandudno. This was reported at the recent quarterly meeting of the North Wales and South Cheshire Electricity Authority. The Electricity Distribution of North Wales & District, Ltd., reported that during the quarter 168 new applications for supplies had been dealt with and 23 by the North Wales Power Co., making a total of 55,412 consumers supplied direct by the companies.

Rawtenstall.—NEW SWITCHGEAR.—The Town Council on October 17th decided to seek powers from the Electricity Commissioners to borrow £22,192 for the erection of a new one-storey building at the electricity station and the installation of switchgear.

Stalybridge.—SUBSTATION EXTENSION.—The Corporation has passed plans from the Central Electricity Board for extension of the substation, etc., at the Hartshead works.

Walsall.—AMENDED HEATING SCHEME.—Ministry of Health officials, having pointed out that a licence for the purchase of steel would be given only if it was needed for the prosecution of the war, the Public Assistance Committee has decided not to proceed with its original scheme for improving the heating system at Beacon Lodge, for which it had sought loan sanction from the Ministry. Instead, it proposes to provide supplementary heating where necessary, and is obtaining an estimate of the cost of electric fires.

West Bromwich.—ANNUAL ACCOUNTS.—The Electricity Committee reports that the total income for the year ended March 31st last was £199,951, as compared with £180,499 in the previous year, an increase of £19,452. The gross profit was £43,128, but after all charges had been paid there was a net profit of £13,701 compared with £19,231 last year. Sales during the year amounted to 58.3 million kWh as compared with 48.8 million kWh in the previous year.

Overseas

Afghanistan.—CONTROL OF ELECTRICITY SUPPLY.—A *Reuter* message from New Delhi states that an electricity company with an authorised capital of 60,000,000 Afghan rupees will shortly be formed in Afghanistan, according to the Kabul news-

(*Continued at foot of page* 372)

Deposits by Consumers

IN the House of Commons on October 16th Mr. De la Bere asked the Minister of Transport whether he was aware that many persons who had lost their homes as a result of enemy action had had to move into homes receiving a supply of electricity from the County of London Electricity Supply Company, Limited, who, before they would supply current were demanding substantial deposits, not for the installation of any apparatus, but in the form of payment in advance; and, in view of the hardship entailed, whether he would take action to prohibit this practice and call on the company to extend sympathy and understanding in these cases of hardship.

Lt.-Col. Moore-Brabazon said that the smaller types of houses and flats were usually fitted with prepayment meters, and the question of deposit did not arise. In other cases where new tenants were unknown to the company and received supplies on a basis of payment at the end of the quarter, the Company had a right to demand a deposit which varied from £1 to £3 according to the size of the premises. The rule about deposits was relaxed for some time, but a large amount of bad debts accumulated and it had been found necessary to reinstate it. He was informed that the Company was acting reasonably in the exercise of its rights and had not only extended sympathy and understanding in cases of hardship but waived debts due to the Company. If his honourable friend had in mind any specific cases of alleged hardship he would be happy to investigate them.

War Emergency Stations

The Central Electricity Board has adopted, without modification, the South-East England and the South-West England and South Wales Electricity (Alteration and Extension) Schemes, 1940, details of which were published on September 27th. Copies of the Schemes, price one penny each, may be obtained from H.M. Stationery Office.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1s. each) can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1939

6593. "Multi-drum winders, hoists and the like. General Electric Co., Ltd., and H. H. Foster. February 28th, 1939. (527016.)

8020. "Coal-cutting or like machines or combined cutting and loading machines." O. F. Lewis, and Newton, Chambers & Co., Ltd. March 13th, 1939. (Addition to 497840.) (527079.)

8482. "Electrical organs." Baldwin Co. March 17th, 1938. (527080.)

8890. "Wireless receiving system." E. P. Rudkin. March 21st, 1939. (527292.)

9286. "Annealing metal alloys." Electric Resistance Furnace Co., Ltd., and H. Knight. March 24th, 1939. (527295.)

9654. "Shaft couplings for machine tools and other machinery or mechanism." S. Wolf & Co., Ltd., and S. G. Nicholson. March 28th, 1939. (527294.)

9689. "Loudspeakers." Standard Telephones & Cables, Ltd. (P. A. J. Visschers.) March 28th, 1939. (527026.)

9690. "Electric power cables." W. H. Duncan. March 28th, 1939. (527027.)

9737. "Electrical signalling systems." Associated Electric Laboratories, Inc. April 4th, 1938. (527035.)

9797. "Electric measuring instruments." H. Fraenkel, and Automatic Coil Winder and Electrical Equipment Co., Ltd. March 29th, 1939. (527039.)

9823. "Arc-extinguishing means in electric circuit-breakers." British Thomson-Houston Co., Ltd. March 29th, 1938. (527042.)

9882. "Indiarubber gloves." E. I. W. Bogard. March 29th, 1939. (527046.)

9931. "Trucks." Associated Electric Vehicle Manufacturers, Ltd., and C. E. Jones. March 30th, 1939. (527051.)

9932. "Electrically propelled road vehicles." Associated Electric Vehicle Manufacturers, Ltd., and C. E. Jones. March 30th, 1939. (527052.)

9952. "Electrical musical instruments." L. Hammond. April 2nd, 1938. (527058.)

9955. "High-pressure metal-vapour electric-discharge lamps, and circuits for operating them." General Electric Co., Ltd., V. J. Francis and J. W. Ryde. March 30th, 1939. (527060.)

10020. "Liquid compositions suitable for electrical insulation." M. H. M. Arnold, and Imperial Chemical Industries, Ltd. March 30th, 1939. (527070.)

10056. "Induction-type electricity integrating meters." Ferranti, Ltd. J. Prince and M. Whitehead. March 31st, 1939. (527087.)

10103. "Electron-discharge devices for use in high-frequency circuits." Marconi's Wireless telegraph Co., Ltd. March 31st, 1938. (527096.)

10104. "Electron-discharge devices." Marconi's Wireless Telegraph Co., Ltd. March 31st, 1938. (527097.)

10111. "Wave-transmission systems." Standard Telephones & Cables, Ltd., and R. A. Meers. March 31st, 1939. (527099.)

10113. "Electro-acoustic devices." Standard Telephones & Cables, Ltd., and J. S. P. Roberton. March 31st, 1939. (527100).

10114. "Electrical condensers of variable capacity." Standard Telephones & Cables, Ltd., R. M. Barnard and F. L. J. Jarvis. March 31st, 1939. (527101.)

10115. "Systems of transmission for television and the like systems." Standard Telephones & Cables, Ltd. May 12th, 1938. (527102.)

10116. "Circuit arrangements applicable to signalling systems utilising currents obtained from elements such as photo-electric cells." Standard Telephones & Cables, Ltd. May 17th, 1938. (527103.)

10117. "Transmission systems for high-frequency electric signals." Standard Telephones & Cables, Ltd. April 23rd, 1938. (527104.)

10145. "Converting arrangements employing electric-discharge devices." Westinghouse Electric International Co. March 31st, 1938. (527112.)

10153. "Method of and apparatus for comparing alternating currents." Elliott Bros. (London), Ltd., and H. S. Petch. March 31st, 1939. (527143.)

10164. "Contact element for an electric socket." British Mechanical Productions, Ltd., and S. T. Deakin. March 31st, 1939. (527120.)

10175. "Thermionic cathodes for use in electron-discharge tubes." Telefunken Ges. für Drahtlose Telegraphie." March 31st, 1938. (527145.)

10181. "Vacuum-tube oscillators." British Thomson-Houston Co., Ltd. March 31st, 1938. (527146.)

10182. "Electric convertor devices." British Thomson-Houston Co., Ltd. March 31st, 1938. (527147.)

10191. "Electrically heated liquid-containing receptacles." Whittaker Bros. (Accrington), Ltd., W. Whittaker, E. H. St. G. Smith and J. A. Duckworth. April 1st, 1939. (527150.)

10209. "Switch and like boxes for use in electricity-distributing systems." R. H. Baker and C. W. Parsons. April 1st, 1939. (527156.)

10231. "Machine-operated electric switches, particularly limit switches." British Thomson-Houston Co., Ltd. April 1st, 1938. (527161.)

10232. "Apparatus for controlling the air flow through air-cooled condensers and the like heat exchange apparatus." British Thomson-Houston Co., Ltd. April 1st, 1938. (527162.)

10233. "Foundry moulding machines." British Insulated Cables, Ltd., R. A. Crook and F. L. Hanna. April 1st, 1939. (527163.)

10240. "Electric switches moved alternately to their two positions by successive reciprocation of an operating member." Contactum, Ltd., and W. Bollinghaus. April 1st, 1939. (527165.)

10242. "Closing apparatus for electric circuit-breakers." A. Reyrolle & Co., Ltd., and J. Mirrey. April 1st, 1939. (527128.)

10260. "Short-wave radio and similar relaying systems." Marconi's Wireless Telegraph Co., Ltd. April 1st, 1938. (527168.)

10264. "Distributors for cables, more especially for television cables." Siemens and Halske Akt. Ges. April 1st, 1938. (Addition to 458641.) (527129.)

10287. "Electric switches and operating-gear therefor, particularly applicable to the control of two or more electric motors." Brookhirst Switchgear, Ltd., and C. Lanceley. April 3rd, 1939. (527308.)

10344. "Television systems." Kolster-Brandes, Ltd., W. A. Beatty, and P. K. Chatterjea. April 3rd, 1939. (527310.)

10352. "Operating systems for high-pressure metal-vapour electric-discharge lamps." General Electric Co., Ltd., and V. J. Francis. April 3rd, 1939. (527185.)

10353. "Electric band-pass crystal filters." General Electric Co., Ltd., and R. F. Proctor. April 3rd, 1939. (527186.)

10354. "Electric locomotives." General Electric Co., Ltd., E. H. Croft and N. W. Robson. April 3rd, 1939. (527187.)

10361. "Thermionic valve amplifiers." Marconi's Wireless Telegraph Co., Ltd. April 1st, 1938. (527188.)

10366. "Indicating boards for use in remote supervisory or like systems." Automatic Telephone & Electric Co., Ltd., and H. J. Moles. April 3rd, 1939. (527222.)

10379. "Self-starting synchronous motors." E. Barraclough and P. A. H. Mossay. April 3rd, 1939. (Addition to 481504.) (527192.)

10386. "Elastic fluid turbines." British Thomson-Houston Co., Ltd. April 1st, 1938. (527193.)

10387. "Apparatus for controlling the air flow through condensers and like heat exchange apparatus on locomotives and other vehicles." British Thomson-Houston Co., Ltd. April 1st, 1938. (527194.)

10388. "Elastic fluid turbines." British Thomson-Houston Co., Ltd. April 1st, 1938. (527195.)

10489. "Mercury switches." Adlake Co. April 14th, 1938. (527212.)

10499. "Electron multipliers." G. Weiss. June 15th, 1938. (527230.)

10504. "Refrigerators." British Thomson-Houston Co., Ltd. April 6th, 1938. (527231.)

10505. "Electric switch contacts." British Thomson-Houston Co., Ltd. April 8th, 1938. (527232.)

10509. "Turbines." Aktiebolaget Ljungstroms Angturbin. April 6th, 1938. (527233.)

10547. "Device for mounting the adjustable core of electric coils." Fabbrica Italiana Magneti Marelli. April 9th, 1938. (527239.)

10587. "Electrical protective circuits." Electrical Research Products, Inc. April 7th, 1938. (527245.)

10599. "Arrangements relating to sound translation and amplification." A. Graham & Co., Ltd., and C. H. Vaughan. April 5th, 1939. (527249.)

10635. "Electric regulating switches." S. Thompson and Tricity Cookers, Ltd. April 5th, 1939. (527260.)

10643. "Amplifiers for echo sounding apparatus." D. S. T. Glazer and R. Marie. April 5th, 1938. (527264.)

10685. "Method and apparatus for measuring the wetness of a vapour." British Thomson-Houston Co., Ltd. April 7th, 1938. (527270.)

10692. "Method of making a joint between a pair of electric cables." British Insulated Cables, Ltd., and J. Chesworth. April 6th, 1939. (527271.)

10718. "Water heaters." Ferranti, Ltd., and J. R. Moore. April 6th, 1939. (527274.)

10744. "Electrolytic condensers." Radiowerk E. Schrack Akt.-Ges. April 11th, 1938. (527323.)

10781. "Calorimetric apparatus." Igranic Electric Co., Ltd. April 30th, 1938. (527333.)

10789. "Teletypewriter apparatus." Standard Telephones & Cables, Ltd. April 7th, 1938. (527335.)

10790. "Printing telegraph system." Standard Telephones & Cables, Ltd. April 6th, 1938. (527336.)

10821. "Protective devices for electric circuits." British Thomson-Houston Co., Ltd. April 8th, 1938. (527343.)

10822. "Refrigerator cabinets." British Thomson-Houston Co., Ltd. April 9th, 1938. (527344.)

10835. "Electrical systems for controlling temperature." Micro Switch Corporation. April 7th, 1938. (527349.)

10837. "Step-by-step electrical transmission systems." Vickers-Armstrongs, Ltd., and J. P. Watson. April 6th, 1939. (527350.)

10926. "Combined lampholder and switch." Raleigh Cycle Co., Ltd., and W. H. Raven. April 11th, 1939. (527134.)

11466. "Electric fuses." Walsall Conduits, Ltd., and E. Gough. April 15th, 1939. (527136.)

1940

3513. "Rotary switches for electric cookers." C. A. Turner and Diamond H Switches, Ltd. March, 13th, 1939. (Divided out of 526754.) (527282.)

12011. "Electric circuit interrupters having arc extinguishing means." Westinghouse Electric International Co. March 25th, 1938. (Divided out of 526849.) (527142.)

12565. "Radiant-heat tubes." W. L. Jones (Electric Furnace Co.). February 18th, 1939. (Divided out of 526746.) (527352.

FINANCIAL SECTION

New Companies. Capital Returns. Debenture Charges. Bankruptcies and Liquidations. Reports and Dividends. Stocks and Shares

Company Registrations

S.B. Engineering Co. Ltd.—Private company. Registered October 7th. Capital £500. Objects: To carry on the business of manufacturers, repairers and distributors of and dealers in refrigerators and cold storage machinery, plant, apparatus and equipment, mechanical, electrical, sanitary, gas, heating and ventilating and general engineers, etc. The directors are: J. A. E. Seabrook, 329, High Holborn, W.C., and H. F. Bamber, 2, Elmfield Road, Chingford. Registered office: 234, Billet Road, Walthamstow.

Verulam Engineers, Ltd.—Private company. Registered October 16th. Capital, £200. Objects: To carry on the business of manufacturers of, and dealers in, all kinds of machinery and apparatus connected with light, heat and electricity, and the projection of light, and with the cinematograph or photographic or allied industries, etc. Directors: C. Fairweather, "Shirley," 33, Shaftesbury Avenue, Preston Road, Harrow, Middlesex, and two others. Registered office: 22-23, Verulam Street, E.C.1.

Companies' Returns

Statements of Capital

Alklum Storage Batteries, Ltd.—Capital, £7,000 in £1 shares. Return dated May 18th. 5,600 shares taken up. £5,600 paid. Mortgages and charges, nil.

Aberayron & District Electricity Supply & Power Co., Ltd.—Capital, £12,500 in £1 shares. Return dated July 8th. 10,000 shares taken up. £7,002 paid. £2,998 considered as paid. Mortgages and charges, nil.

John Davis & Son (Derby), Ltd.—Capital, £35,000 in 30,000 ordinary and 5,000 unclassified shares of £1. Return dated July 17th. 30,000 ordinary shares taken up. £15,000 paid. £15,000 considered as paid. Mortgages and charges, nil.

G. L. Adamson, Ltd.—Capital, £7,500 in £1 shares. Return dated July 9th. 6,236 shares taken up. £1,736 paid. £4,500 considered as paid. Mortgages and charges, nil.

W. H. Porter & Co., Ltd.—Capital, £100 in £1 shares. Return dated May 31st. 90 shares taken up. £90 paid. Mortgages and charges, £2,000.

Invincible Electrical Engineering Co., Ltd.—Capital, £1,000 in £1 shares. Return dated July 24th. 400 shares taken up. £400 paid. Mortgages and charges, nil.

Ekram Electric, Ltd.—Capital, £1,000 in £1 shares. Return dated July 26th. 700 shares taken up. £700 paid. Mortgages and charges, nil.

Star Electrical Co., Ltd.—Capital, £1,000 in 500 preference and 500 ordinary shares of £1. Return dated July 26th. 500 preference and 10 ordinary shares taken up. £510 paid. Mortgages and charges, £1,100.

Air Ducts, Ltd.—Capital, £10,000 in £1 shares. Return dated July 18th. 9,503 shares taken up. £9,503 paid. Mortgages and charges, nil.

Hassocks & Hurst Electricity Co., Ltd.—Capital £5,000 in £1 shares. Return dated June 27th, 1940. All shares taken up. £250 (1/- per share) paid. Mortgages and charges: Nil.

Allbright Electric Co., Ltd.—Capital £20,000 in £1 shares. Return dated June 27th, 1940. All shares taken up. £14,000 paid. £6,000 considered as paid. Mortgages and charges: Nil.

Second Electric Supply Corporation, Ltd.—Capital, £5,000 in £1 shares. Return dated June 27th. All shares taken up. £250 (1s. per share) paid. Mortgages and charges, nil.

Mortgages and Charges

Westool, Ltd.—Assignment dated October 3rd, 1940, charged on moneys due or to become due under certain contracts, to secure all moneys due or to become due from the company to Barclays Bank, Ltd.

Llanidloes Electric Light Co. (1926), Ltd.—Satisfaction to the extent of £1,000 on September 27th, 1940, of debentures authorised June 5th, 1936, and registered June 9th, 1936.

R. E. Thompson & Co. (Sunbury), Ltd.—Deposit on September 26th, 1940, of deeds of Albert Works, Avenue Road, Hampton, Middlesex, to secure all moneys due or to become due from the company to Barclays Bank, Ltd.

Increase of Capital

Insulators, Ltd.—The nominal capital has been increased by the addition of £10,000, in £1 ordinary shares, beyond the registered capital of £15,000.

Bankruptcies

S. H. Holly, 4, South Street, Wareham, electrician.—This debtor's application for his discharge recently at the Law Courts, Bournemouth, was granted, subject to one month's suspension.

G. C. Pinney and **A. E. Miller** (Granby Service Co.), wireless and electrical dealers, 4, Granby Street, Littleport, Cambs.—Trustee, Mr. F. E. Bendall, 4, Charterhouse Square, London, E.C.1, released September 18th.

E. A. Kann, electrical and radio manufacturer, 61, Lansdowne Place, Hove.—Receiving order made October 9th on a creditor's petition.

J. H. Matthews, electrical dealer, 232, Town Street, Bramley, near Leeds.—Receiving order made October 8th on debtor's own petition.

Liquidations

Power, Radiance & Co., Ltd.—Winding-up voluntarily. Liquidator, Mr. C. B. Brecknock, 2, King Street, Nottingham.

Engineering & Lighting Equipment Co., Ltd.—Meeting, November 18th at Sphere Works, St. Albans, to receive an account of the winding-up by the liquidator, Mr. G. Little.

Reports and Dividends

The British Electric Resistance Co., Ltd., reports a trading profit for the year ended July 31st of £20,965, as compared with £11,578, from which are deducted directors' fees, income tax and E.P.T. totalling £13,349. The dividend for the year is 20 per cent., less tax (against 10 per cent.), and £4,185 is carried forward (against £2,320 brought in). The assets and liabilities of the subsidiary, Electrical Products, have been merged into the balance sheet of the parent company and the former has now practically ceased trading, its products being manufactured by the B.E.R. Company. As from August 1st, 1940, a new wholly owned subsidiary called the British Power Transformer Co., took over the transformer section of the business as it is considered desirable that these products should be handled under a distinctive name.

Oliver Pell Control, Ltd., reports a gross trading profit of £19,451, as compared with £36,988, plus rents £656, and after deducting management expenses, loan and debenture interest, depreciation, etc., there is a debit of £1,063, as compared with a profit of £16,304 in the preceding year. During the year it was found necessary to adjust the value of stock and work in progress as at March 31st, 1939, with the result that a credit of £18,087 at that date was converted into an adverse balance. After writing off various items and providing for trading loss, the debit carried forward is £11,688. The directors state that during the last three months of the year relatively satisfactory profits were made and since the date of the accounts there has been a very considerable improvement.

A. C. Cossor, Ltd., held their annual meeting on October 23rd, when Mr. T. A. Macauley (chairman) said that it was to be expected that their contribution to the present war effort would provide a material increase in output, but nevertheless their general valve and set business had been substantially maintained notwithstanding the inevitable limitations imposed by present conditions. Total sales for the year showed an advance of nearly 30 per cent. upon those of the previous year. Both operating subsidiaries were now showing satisfactory profits. As their Government contracts increased it was natural that their production of radio sets should decline. They were satisfied, however, that their proportionate position in the radio industry had been maintained.

Murex, Ltd., reports a trading profit for the year ended June 30th of £490,440, an increase of £222,879 as compared with the preceding year. Dividends, interest and sundry income amounted to £44,547, and after deducting expenses, directors' fees and legal charges, there is a profit balance of £526,408 (against £337,329). A sum of £302,353 has been reserved for taxation, a loss of £1,307 on the realisation of investments during the year has been written off and provision of £50,172 has been made for investments in enemy occupied territory. The ordinary distribution for the year is maintained at 20 per cent., less tax, including 2½ per cent. bonus. General reserve receives £37,070 and the balance carried forward is £103,423 (against £90,167 brought in).

Canadian Securities Taken Over.—The Treasury made further vesting orders on October 26th by which about sixty Canadian dollar securities are to be taken over by payment in sterling to holders in this country. Among the companies whose issues are affected are the Bell Telephone Co. of Canada, British Columbia Power Co., Shawinigan Light and Power Co., Montreal Light, Heat and Power Consolidated, and a number of other power undertakings.

The Perak River Hydro-Electric Power Co. reports that the balance carried to net revenue account for the year ended July 31st amounted to £320,184 as compared with £153,869 for 1938–39. It is proposed to pay a dividend of 5 per cent. plus a bonus of 1 per cent., both less tax on the ordinary shares. For the previous twelve months a dividend of 2½ per cent. less tax was distributed on the ordinary capital.

The Shropshire, Worcestershire & Staffordshire Electric Power Co. is paying an interim dividend of 4 per cent. on the "A" ordinary shares, and of 2½ per cent. on the "B" ordinary shares. These are at the same rates as for the preceding year.

The South Wales Electric Power Co. is maintaining its interim dividend at 2 per cent.

Electric & Musical Industries, Ltd., earned a profit of £38,048 for the year ended September 30th. In 1938–39 a net loss of £131,968 was reported. It is not proposed to declare a dividend on the ordinary shares; the last payment was 5 per cent. for 1937–38.

Crabtree Electrical Industries, Ltd., have declared a final ordinary dividend of 5 per cent., plus a cash bonus of 7½ per cent., making 17½ per cent. for 1939-40 (same).

The Ever-Ready Company (Gt. Britain), Ltd., has declared an interim dividend on the ordinary shares of 15 per cent. (unchanged).

The Quebec Power Co. is paying a quarterly dividend of 25 cents to September 30th (same).

STOCKS AND SHARES

TUESDAY EVENING.

MARKET conditions nowadays show little change from one week to another except when, as occasionally happens, the news appears to point to some possible fresh development. At the moment the political situation between France, Spain and Germany, is regarded as a reason for caution, but from the point of view of Stock Exchange markets, it has made practically no difference to the firmness of prices.

The House is again dealing on the floor of the Stock Exchange. This means a considerable addition to members' convenience and comfort as compared with the cramped state of affairs that prevailed last week when transactions were taking place in the Settling Room in the basement of the House.

Government Insurance

The Government's announcement that compensation is to be paid on property damaged by war action, and that this will be retrospective to the beginning of the war, has had a strengthening effect upon the shares in a good many industrial companies. Some time ago, it was observed here that holders of home electricity supply shares were then disposed to realise their interests, lest enemy action should put their property out of operation. Later, it was suggested that an association should be formed between the companies, the various municipal bodies and Boards such as the C.E.B., in order to raise a fund that could be drawn upon for the benefit of any individual member whose property suffered damage through air-raid or other such action. Since then, the Government scheme for providing compensation has been introduced and, although up to the time of writing nothing has been said as to the amount of premium that would be required for carrying out this insurance, the fact of property becoming compulsorily insured is held to be a bull point for industry as a whole.

Home Railway Charges

It will be seen from our list of prices in the railway section, that gains of three points each have been secured by Southern Railway 5 per cent. preferred and the same railway's 5 per cent. preference stocks. The Minister of Transport has announced that as from Friday, December 1st, all railway goods rates, ordinary fares and L.P.T.B. coach fares are to be increased by about 6 per cent. This follows the main recommendation in the report of the Railway Control Consultative Committee. That no increase is to be made in the rates of season tickets. workmen's fares, or ordinary fares on the Transport Board services, with the exception of the coaches, is regarded as a sensible concession. Lieut.-Col. Moore-Brabazon points out that the increase of 6 per cent., plus the 10 per cent. which came into operation on May 1st last, represents an increase of approximately 16¾ on pre-war charges. London Passenger Transport issues are unchanged in price, but the rest of the group has gone ahead.

The Government Agreement

The agreement which the Government made with the railways last February is liable to be revised at the end of the present year, and this imparts an element of uncertainty to the present position. The buying movement which brought about the improvements in Southern and other Home Railway stocks has been mainly on behalf of the smaller investor, who has realised the extremely high yields that the stocks were offering at their previous figures. Whether the latter can be maintained in the face of the indifference of the public to the Home Railway market remains to be seen.

Manufacturing and Equipment

Noticeable strength is shown in the prices of these companies. British Aluminium are 2s. 6d. up to 39s. 6d., and British Insulated at 77s. 6d. have put on a similar amount. Associated Electrical ordinary and preference, Callender's, Crompton's, Enfield and English Electric are all ¼ up. General Electrics are a good market at 71s. 3d. bid. Several of the preference issues have come into demand. Ferranti sevens at 23s. 9d. have gained 6d.; Scottish Power sixes, in the supply group, are better at 26s. 6d.

Dividend Declarations

The Ever Ready Co. has declared its usual interim dividend of 15 per cent., and this has attracted a little attention to the shares, which at the present price of 25s. give a yield of 8 per cent. on the money. A more spectacular announcement is that from the Perak River Hydro Electric Co., the 2½ per cent. of last year being followed now by 5 per cent. dividend and 1 per cent. bonus. This came as a pleasant surprise, for last year the 2½ per cent. was distributed only by scraping the pot fairly clean, to put it colloquially. At that time, it was thought that the policy of the board would subsequently be directed to fortifying reserves, etc., rather than to the distribution of profits. Evidently the substantial advance in the quota for tin production has greatly benefited the company, and the result, as just mentioned, is as pleasant as it is surprising. The price of the shares is ¼ harder at 13s. 9d., at which, on the 2½ per cent. dividend, the yield was no more than 3⅝ per cent. On the increased 6 per cent. dividend, the return now comes to 8 per cent. on the money. Shropshire, Worcestershire & Staffordshire Electric Power Co. has declared interim dividends of 4 per cent. on the "A" ordinary shares and 2½ per cent. on the "B" ordinary; the same rates as those in the previous year. Over 90 per cent. of these "A" and "B" shares are held by Edmundson's Electricity Corporation.

The Murex figures for the year recently ended are considered in the market to be exceedingly good. The trading profit rose by £220,000 and the profit balance of £526,000 is £190,000 up. Provision of £50,000 has been made for investments in enemy-occupied territory. The dividend and bonus come to 20 per cent. for the year—the same as usual—and the price of the shares has risen to 71s. 3d., which shows a yield on the 20 per cent. dividend of £5 12s. 4d. per cent. on the money.

Cable Investment Trust

Mention was made here a few weeks ago of a line of Cable Investment Trust 3½ per cent. debenture stock, then on offer at about 90. The security for the issue seemed likely, it was pointed out, to suffer depreciation from the falls in prices during the past year. The recent report showed that the book value of the Cable Investment Trust's investments was £7,106,000, where the market value of the securities at June 30th last amounted to £4,840,174. Lord Pender, presiding at the meeting of the company, declared that in present conditions a valuation bore no relation to the intrinsic value of the securities. "The result of the year's working," he said, "showed that our securities had yielded a very stable return." A dividend of 5 per cent., less tax, was declared on the ordinary stock.

The line of debenture stock that was on offer when mentioned here, experienced no difficulty in finding a home. At the moment, it is now easier to sell the stock than it is to buy it. The issue is redeemable by drawings, £15,000 per annum at 101, or by purchase in the market at or under 101. Any stock outstanding on December 1st, 1965, will be repaid at 101.

In his speech at the Cable Investment Trust meeting, Lord Pender remarked that debenture stock amounting to £15,000 had been purchased and cancelled during the year to June 30th, 1940, in accordance with the trust deed, and a further £10,000 had been purchased and is available for re-issue. It would appear from Lord Pender's observation that the company had bought £10,000 of its own stock, and that it is now ready to sell it again if a buyer should come along.

Surplus Lands

An occasional bargain takes place in the 10s. shares of the Metropolitan Railway Surplus Lands Company, quoted at 4s. 9d. For 1939, an interim dividend of 1⅜ and a final of 1⅛ per cent. were paid. Last July, the interim dividend in respect of the year ended 31st December, 1940, was 1 per cent. The company was formed to take over from the Metropolitan Railway Co. the undertaking of the Surplus Lands Committee, the issued capital is a little over £2½ millions. In the period 1934-1938, the annual dividends were 3⅝ per cent. on the ordinary stock. The highest price in 1936 was 12s. The policy of the board in regard to dividends is to make what, at the last meeting, the chairman described as one major operation, rather than a series of minor ones. If the position did not deteriorate still further, he said, the board might feel that the major operation had been successfully performed, and that the period of convalescence had begun. The recent results of the air raids cannot be said to encourage optimism with regard to the outlook, but at anything like 4s. 9d. these Metropolitan Surplus Lands shares look a useful lock-up for the long shot. There is, it may be well to add, a narrow market in the shares.

The Telephone Trouble

Nobody with any acquaintance of current conditions will refuse to acknowledge that to carry on the telephone service with efficiency at the present time must be a difficult job. Subscribers to the British telephone have become accustomed to a service which, however sharply criticised, did perform its duties with reasonable satisfaction to its constituents. Lately, however, it very marked deterioration has been the subject of general comment. Maybe sufficient allowance is not made for the new problems that the Telephone Department is called upon to face. No doubt adjustment to present conditions is already being undertaken with what speed is possible. But after using all the arguments which can be advanced in defence of the Telephone Department, the fact remains that the service is undeniably bad. The Postmaster-General has a serious responsibility that calls for immediate action.

ELECTRICAL COMPANIES' SHARES

Prices, Dividends and Yields

Company	1940 High-est	1940 Low-est	Dividend Pre-vious	Dividend Last	Middle Price Oct. 28	Rise or Fall	Yield £ s. d.
Home Electricity Companies							
Bournemouth and Poole ..	63/6	37/6	15	15	38/9	+⅛	—
British Power and Light ..	30/–	21/–	7	7	23/6	..	5 19 2
City of London	28/–	20/–	7½	7½	20/–	..	—
Clyde Valley	38/6	25/–	8	8	31/3	..	5 2 5
County of London ..	43/3	22/–	10½	10½	27/6	+⅛	7 12 8
Edmundson's:							
7% Pref	31/6	26/3	7	7	28/3	..	4 19 1
Ord...	27/6	18/6	9	6	22/–	..	5 9 1
Elec. Dis. Yorkshire ..	40/3	32/6	9	9	32/6	..	5 10 9
Elec. Fin. and Securities ..	41/3	34/6	12½	12½	38/9xd.	+6d.	6 9 0
Elec. Supply Corporation..	46/3	37/–	12	11½	37/0	..	6 4 4
Isle of Thanet	16/–	5/6	4	4	6/–	..	—
Lancs Light and Power ..	33/–	25/–	7½	7½	25/0	..	5 16 6
Llanelly Elec.	21/–	17/–	5½	5½	17/6	..	6 5 9
Lond. Assoc. Electric ..	21/–	12/6	7	5½	13/3	..	—
London Electric	37/6	19/–	8	7	20/–	..	7 0 0
London Power Deb. Red...	105½	101	5	5	100½	..	4 19 6
Metropolitan	41/6	23/6	12	10	27/6	..	7 5 6
Midland Counties	39/–	24/3	8	8	27/6	..	5 16 5
Mid. Elec. Power	40/–	29/6	9	9	32/–	..	5 12 6
Newcastle Elec.	29/9	22/6	7	7	22/6	..	6 7 3
North Eastern Elec.:							
Ordinary..	31/6	17/6	7	7	22/6	..	6 4 5
7% Pref...	32/6	26/6	7	7	27/6	..	5 1 10
Northampton	48/–	39/–	10	10	38/9	..	5 3 3
Notting Hill 6% Pref. (£10)	10¼	9	6	6	9	..	—
Northmet Power:							
Ordinary..	42/3	23/–	10	10	28/3	..	—
6% Pref...	29/–	23/–	6	6	26/–	..	4 12 4
Richmond Elec. ..	24/6	18/–	7	6	18/9	..	—
Scottish Power	38/–	24/–	8	8	28/9	..	5 11 5
Southern Areas	21/3	13/9	5	5	12/6	..	8 0 0
South London	23/3	20/–	7	7	20/–	..	7 0 0
West Devon	20/–	18/6	5	5	20/–	..	5 0 0
West Glos.	21/3	15/–	2½	4½	16/3	..	5 10 10
Yorkshire Elec.	40/–	24/6	8	8	29/6	+9d.	5 8 6
Overseas Electricity Companies							
Atlas Elec.	4/–	1/3	Nil	Nil	1/9	..	—
Calcutta Elec.	37/–	22/6	10*	8*	30/-xd.	+1/–	5 6 8
Cawnpore Elec.	30/–	24/–	10	10	25/–	..	8 0 0
East African Power ..	25/6	20/–	7	7	20/–	..	7 0 0
Jerusalem Elec.	24/–	17/9	7	7	16/3	−½	8 12 4
Kalgoorlie (10/-)	12/6	9/6	7½	7½	11/-xd.	..	6 16 5
Madras	26/9	23/6	8*	6*	25/–	..	4 16 1
Montreal Power	35½	30	1½	1½	32	..	—
Palestine Elec. "A" ..	25/–	12/6	5*	Nil	12/6	..	—
Perak Hydro-electric ..	20/3	13/6	2½	6	15/–	..	8 0 0
Shawinigan Power ..	27½	19	83cts.	90cts.	20	..	—
Tokyo Elec. 6%	69	52	6	6	30	..	20 0 0
Victoria Falls Power ..	75/9	56/–	15	15	65/–	..	4 12 4
Whitehall Investments Pref.	17/9	8/–	7½	7½	10/–	..	15 0 0
Public Boards							
Central Electricity:							
1950–70	110½	104	5	5	105½	+1	4 14 8
1955–75	112½	106	5	5	107½	..	4 13 0
1951–73	107½	102	4½	4½	103½	+1	4 7 0
1963–93	96½	90	3½	3½	91	..	3 17 0
London Elec. Trans.Gtd...	92	87½	2½	2½	93	+1	2 13 9
London & Home Counties							
1955–75	113½	105	4½	4½	105½	..	4 5 4
Lond. Passenger Transport:							
A	116	104	4½	4½	106	..	4 5 0
B	116	102½	5	5	104½	..	4 15 8
C	65½	25	1½	1½	27	..	5 11 2
West Midland Joint Elec.							
1948–68	106½	103	5	5	105½	..	4 14 9
Telegraph and Telephone							
American Tel. & Tel. ..	215	180	9	9	200	..	4 10 0
Anglo-Am. Tel.:							
Pref.	106	85	6	6	92½xd.	+1½	6 9 5
Def.	23½	18	1½	1½	21½	..	6 19 6
Anglo-Portuguese	22/6	10/–	8	8	15/–	..	10 13 4
Cable & Wireless:							
5½% Pref.	99½	70	4½	5½	85	−1	6 9 5
Ord.	65	28½	4	4	50	..	8 0 0
Income	99½	93	..	..	97	..	4 0 0
Canadian Marconi $1 ..	6/–	4/–	Nil	4cts.	4/6	..	—
Globe Tel. & Tel.:							
Ord.	32/6	21/6	7½*	6*	25/–	..	4 16 0
Pref.	22/9	22/6	6	6	23/9	..	5 1 1
Great Northern Tel. (£10)	20	11	20	20	12½	..	—
Inter. Tel. & Tel.	5½	3	Nil	Nil	3½	..	—
Marconi-Marine	30/–	18/3	10	7½	18/9	..	8 0 0
Oriental Telephone Ord. ..	2¾	47/6	12*	11½*	2¾	..	4 16 10
Telephone Props.	15/–	11/–	5	6	12/6	..	9 12 0
Telephone Rentals (5/–) ..	9/6	5/9-	10	10	6/3	..	8 0 0
Traction and Transport							
Anglo.Arg. Trams:							
First Pref. (£5)	4/3	1/3	Nil	Nil	2/–	..	—
4% Inc.	11½	2	Nil	Nil	7	+2½	—
British Electric Traction:							
Def. Ord.	830	440	5	45	675—25	..	6 13 4
Pref. Ord.	169	134	8	8	140	..	5 14 3
Bristol Trams	48/6	34/6	10	8*	35/–	..	—
Brazil Traction	12½	5½	$1	50c.	5½	..	—
Calcutta Trams	24/–	16/3	8	5½	17/–	..	6 9 4
Cape Elec. Trams	18/6	16/–	5	5	17/–	..	5 17 8
Lancs Transport	35/–	27/6	10	10	30/–	..	6 13 4
Mexican Light:							
1st Bonds	36	27	5	5	35	..	—
Rio 5% Bonds	95	74	5	5	90	−5	5 11 3
Southern Rly.:							
5% Prefd.	79	35	5	5	44½	+3	11 4 8
5% Pref...	104½	60	5	5	74½	+3	6 14 3
T. Tilling	45/9	31/–	10	10	38/9	+⅛	5 3 1
Tilling & B.A.	47/6	41/9	9*	8*	42/–	..	—
West Riding	35/–	26/–	10	10	31/–	..	6 9 0
Equipment and Manufacturing							
Aron Electricity Ord. ..	17/6	10/–	15	Nil	14/–	..	—
Assoc. Elec.:							
Ord.	43/3	27/–	10	10	36/3	+⅛	5 10 4
Pref.	35/3	32/3	8	8	35/–	+⅛	4 11 5
Automatic Telephone & El.	47/3	32/–	12½	12½	37/6	..	6 13 4
Babcock & Wilcox ..	50/–	28/6	10	11	35/–	..	6 5 9
British Aluminium Ord. ..	56/–	33/–	12½	12½	39/6	2/6	—
British Insulated Ord. ..	92/6	67/–	20	20	77/6	1/8	5 6 8
British Thermostat (5/–) ..	14/9	6/6	18½	18½	9/6	9d.	9 14 8
British Vacuum Cleaner (5/-)	12/6	4/9	40	12½	6/3	..	10 0 0
Brush Ord...	4/6	1/9	Nil	Nil	2/6	..	—
Callender's	69/–	46/–	15	15	56/3	+⅛	5 6 9
Chloride Elec. Storage ..	72/6	55/–	15	15	2½	..	5 4 4
Consolidated Signal ..	72/6	59/–	36½	17	60/–	..	5 13 4
Crabtree (10/–)	24/9	17/6	17½	17½	21/3	..	8 4 9
Crompton Parkinson:							
Ord. (5/–)	20/–	12/6	30	20	15/–	+⅛	6 13 4
E. K. Cole (5/–)	5/–	2/6	10	Nil	3/6	..	—
Elec. & Musical Industries							
(10/–)	10/3	4/3	5	Nil	8/–	−6d.	—
Electric Construction ..	36/3	37/6	13½	10	27/6	..	7 5 6
Enfield Cable Ord. ..	56/–	40/6	25	16½	45/–	+⅛	7 5 5
Electrical Switchgear (10/-)	22/6	20/–	16	10	20/–	..	5 0 0
English Electric	33/9	16/6	10	10	26/3	+⅛	7 12 4
Ensign Lamps (5/–) ..	15/3	12/6	25	25	13/9	..	9 1 10
Ericsson Tel. (5/–) ..	39/3	25/–	25*	25*	25/–	..	—
Ever Ready (5/–)	28/3	17/3	30	40	25/–	..	8 0 0
Falk Stadelmann	18/3	12/6	6	7	13/9	..	10 3 8
Ferranti Pref.	25/–	23/–	7	7	23/9	+6d.	5 18 0
G.E.C.:							
Pref.	32/6	27/–	6½	6½	28/9	..	4 10 6
Ord.	83/3	56/–	20	20	71/3	+⅛	5 12 1
Greenwood & Batley ..	25/6	20/–	15	13	20/–	..	13 0 0
Hall Telephone (10/–) ..	18/6	8/9	15	10	11/3	..	8 17 10
Henley's (5/–)	21/6	13/6	20	20	17/6	..	5 14 3
4½% Pref.	21/3	20/6	4½	4½	21/3	..	4 4 8
Hopkinsons	46/9	35/6	12½	15	33/9	..	8 18 0
India-Rubber Pref. ..	21/–	19/6	5½	5½	20/–	−⅛	5 10 0
Intl. Combustion	121/3	70/–	32½	32½	3½	..	8 13 4
J. Lucas	60/6	40/–	15	15	47/6	..	6 6 4
Johnson & Phillips ..	50/9	33/–	12½	15	40/–	..	7 10 0
Lancashire Dynamo ..	59/9	47/6	25	20	47/6	..	8 8 5
Laurence Scott (5/–) ..	11/–	6/–	15	15	8/–	..	9 7 6
London Elec. Wire ..	25/6	20/–	7½	7½	22/6	..	6 13 4
Mather & Platt	46/6	30/–	13½	10	33/9		5 18 6
Metropolitan Elec. Cable Pf.	22/–	21/3	5½	5½	21/3	..	5 3 6
Murex	86/9	52/6	20	20	71/3	+⅛	5 12 4
Pye Deferred (5/–) ..	9/–	6/9	25	25	8/9	..	14 5 8
Revo (10/–)	20/9	11/6	17½	5	17/6	..	2 17 6
Reyrolle	60/6	41/–	12½	12½	45/–	..	5 11 2
Siemens Ord.	23/9	16/3	7½	7½	16/3	..	9 4 8
Strand Elec. (5/–) ..	2/3	9d.	10	4	1/3	..	16 0 0
S. Smith (1/–)	8/–	3/6	37½	50	7/6	..	6 13 4
Switchgear & Cowans (5/–)	11/9	5/6	20	10	7/–	+9d.	7 2 10
Telegraph Condenser (10/–)	8/9	6/3	5	..	7/6	+6d.	—
Telegraph Construction ..	42/6	29/–	10	10	31/3	..	6 8 0
Telephone Mfg. (5/–) ..	9/–	5/–	9	9	5/9	..	7 16 6
Tube Investments.. ..	96/9	61/3	23½	23½	82/6	..	5 16 0
Vactric (5/–)	3/6	2/–	4	Nil	2/3	..	—
Vickers (10/–)	22/–	9/6	10	10	14/–	..	7 2 10
Ward & Goldstone (5/–) ..	19/9	12/6	20	20	12/6	..	8 0 0
Westinghouse Brake ..	46/–	32/6	17½	10	32/6	..	6 3 1
Walsall Conduits (4/–) ..	26/6	17/6	55	55	23/9	..	9 5 0
West, Allen (5/–)	7/–	3/–	10	7½	3/9	..	10 0 0

* Dividends are paid free of Income Tax.

CONTRACT INFORMATION

Particulars of work for which tenders are invited, contracts placed, and building schemes promising work for electrical contractors and traders

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parenthesis. Further details of items marked with an asterisk can be obtained from the Department of Overseas Trade (Inquiry Room), Great George Street, London, S.W.1.

Australia.—SYDNEY.—County Council. One 50,000 kW steam turbo-alternator set for Bunnerong power station. The closing date for the receipt of tenders has been extended from October 24th to January 9th, 1941.

Birkenhead.—November 18th. Electricity Department. E.h.v. cable, l.v. cable (paper insulated), l.v. cable (rubber insulated), meters & general stores for six months, commencing January 1st, 1941. (See this issue.)

Blaydon-on-Tyne.—Electric lighting in public shelters; T. Mills, surveyor, Urban District Council Offices, Blaydon-on-Tyne.

Middlesbrough.—Electric lighting in a cleansing station and in 23 shelters; Cecil Gorman, borough engineer, Town Hall, Middlesbrough.

New Zealand.—WELLINGTON.—Public Works Department. November 26th. 40-ton three-motor electric overhead travelling crane. (T.22012/40.)*

20,000-kVA 11,000-V synchronous condenser. Closing date for receipt of tenders extended to November 5th. (T. 21199/40.)*

January 14th. Two 3,000-kVA, 11-kV, three-phase, 50-cycle outdoor-type voltage regulating transformers and control equipment for the Matmata and Edgecombe substations. (T.22238/40.)*

South Africa.—PRETORIA.—Union Tender & Supplies Board. November 14th. Ten batteries each of 12 cells. (T. 21981/40.)* 7,500 telephones, table, magneto. (T. 21980/40.)*

December 12th. Electric light fittings for the new G.P.O., Bloemfontein. (T. 22426/40.)*

CAPE TOWN.—November 12th. Electricity Supply Commission. Two 300-kVA three-phase transformers. (T. 21801/40.)*

November 18th. 910 yd. 0.2 sq. in. three-core belted type cable, 11,500/12,000 V, and 910 yd. six-core 7/.029 in. pilot cable. (T. 21988/40.)*

November 20th. City Council. Low-voltage industrial-type switchboard. (T. 22052/40.)*

December 4th. Laundry equipment. (T. 21987/40.)*

JOHANNESBURG.—November 14th. City Council. Electric lighting fittings for new magistrates' courts. (T. 21976/40.)*

January 4th. Plant at gasworks, Cottesloe: (a) One 200-kW rotary convertor and associated equipment. Alternatively (b) one 200-kW mercury arc rectifier or (c) two 100-kW mercury arc rectifiers. (d) Equipment for spare power circuit frame. (T. 22424/40.)*

Railways and Harbours Administration. November 18th. Electrical signal material. (T. 22396/40.)*

Straits Settlements.—SINGAPORE.—November 11th. Municipal Electricity Department. Three 300-kVA and five 500 kVA static transformers. (T. 1826/40.)*

West Riding.—County Police Authority. Electrical work in connection with the adaptation of premises at Bishopgarth, Wakefield. Plans by the County Architect, County Hall, Wakefield.

Wolverhampton.—November 12th. West Midlands Joint Electricity Authority. Standard frequency high- and low-voltage AC cables and low-voltage DC cables. (See this issue.)

Orders Placed

Bedford.—Electricity Committee. Accepted. Switchgear for twelve months. Metropolitan-Vickers Electrical Co.; Ferguson, Pailin, Ltd. Earth fault and short-circuit protection equipment (£284), and instrument panel (£6).—B.T.H. Co. Two PB relays (£54).—Metropolitan-Vickers Electrical Co.

Blackburn.—Electricity Committee. Accepted. Creeper grab crane (£1,300).—Priestman Bros., Ltd.

Blackpool.—Emergency Committee. Accepted. 100 battery-operated lanterns and 20 additional batteries.—J. E. Wildbore & Co.

Bootle.—Electricity Committee. Accepted. Cable for twelve months.—Liverpool Electric Cable Co.

Coventry.—Housing Committee. Accepted. Electrical work at 896 houses (£10,724).—L. R. Gunton.

Darlington.—Town Council. Accepted. Cable.—Callender's Cable and Construction Co.

Dewsbury.—Town Council. Accepted. Supply of electrical apparatus and equipment for electricity substations, installation of master controller, 255 receiving units and adaptors, and four sirens for A.R.P. work (£3,542).—Standard Telephones and Cables, Ltd.

Gateshead.—Town Council. Accepted. Electrical installation at the new Shipcote Baths (£437).—Sleigh and Wood.

London. — WESTMINSTER. — Highways Committee. Accepted. Five rectifier bulbs for battery-charging units (£30 each).—Nevelin Electric Co.

Middlesbrough.—Town Council. Accepted. Cable.—Britannic Electric Cable Co.

Newcastle-on-Tyne.—City Council. Accepted. Electric cable for an emergency electricity supply to tramways (£466).—B.I. Cables.

Portsmouth.—Electricity Committee. Accepted. Fire protection equipment (£1,234).—Mather & Platt.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Blackpool.—Works additions; BeeBee Biscuits, Ltd.

Day nursery; borough engineer.

Chester.—Works shelters; Williams, Ltd.

Chichester.—Sewage works plant; town clerk, 61, North Street, Chichester.

Coventry.—Works extensions; British Piston Ring Co., Ltd.

Factory extensions; A. C. Wickham, Ltd.

Dartford.—Factory; Abwood Engineering Co. Ltd.

Dudley.—Shelters (£3,474); borough engineer.

Dunston-on-Tyne.—Extensions to a factory; Cackett, Burns, Dick & McKellar, architects, Ellison Place, Newcastle.

Essex.—Shelters at various institutions (£15,000); county architect.

Falkirk.—Works extensions for R. and A. Main.

Flintshire.—Communal shelters (118), and public shelters (19); R. G. Whitley, county architect, County Buildings, Mold.

Gateshead.—Shelters at Stannington Hospital (£3,250); R. Carse and Son, builders, Amble.

Greenock.—Rebuilding wool store; Fisher Henderson & Co., Ltd.

Hawick.—School shelters (£2,100); burgh surveyor, Municipal Buildings, Hawick.

Kidderminster.—Works offices; Smethwick Drop Forgings, Ltd.

Lancashire. — Decontamination laundry, Ashton-under-Lyne; S. Wilkinson, county architect, County Offices, Preston.

Lancaster.—Power house, etc. (£55,000), Royal Albert Institution; secretary to Management Committee, Albert House, Lancaster.

Leigh.—Buildings and garages at refuse destructor works; T. A. Clare, borough surveyor, Town Hall.

London.—Garages, etc., for fire brigade (£100,000); L.C.C. architect.

WESTMINSTER. — Shelters for homeless (£10,000); city engineer.

Manchester.—Reconstruction of premises for David Jones & Co. Ltd.; T. Wainwright & Son, architects, 11, Lord Street, Liverpool.

Marple.—Domestic communal shelters for U.D.C.; T. Cooper, surveyor, Council Offices.

Morley.—Extensions to workshop; A. Hartley.

Newcastle-on-Tyne.—Deep air-raid shelters; P. Parr, city engineer.

Oxford.—Additional public shelters; city engineer.

Rawtenstall.—Works extensions; Glendale Yarns, Ltd.

Extensions to works; H. Trickett & Son, Ltd.

Rubery.—Estate development; Harrison Porritt, Ltd., builders, Greenland Estate, Redditch.

Saffron Walden. — Domestic shelters (£6,464); borough engineer, Hill Street, Saffron Walden.

Sheffield.—Pump house (£4,607); city engineer.

Stockport.—Tunnel shelters for 5,000 persons; Wm. F. Gardner, borough engineer, Town Hall.

Stoke-on-Trent.—Cleansing depots; A. Burton, city engineer, Town Hall.

Communal feeding centres (£5,000); J. R Piggott, chief architect, Town Hall.

Sunderland.—Improvements to railway station; L.N.E.R., York.

Tipton.—Additions to works; Revo Electric Co., Ltd.

Uttoxeter.—Houses in rural area; C. E. Ingham, surveyor, Market Place.

Wakefield. — Public shelters; W. E. Massie, engineer and surveyor, 18, St. John's North, Wakefield.

Wellington (Somerset).—Public shelters (50 persons each) for U.D.C.; E. T. Howard, surveyor, Council Offices, 35, Fore Street, Wellington, Somerset.

Windermere.—Extensions to Grammar School; Walker, Carter and Walker, architects, Institute Buildings, Crescent Road.

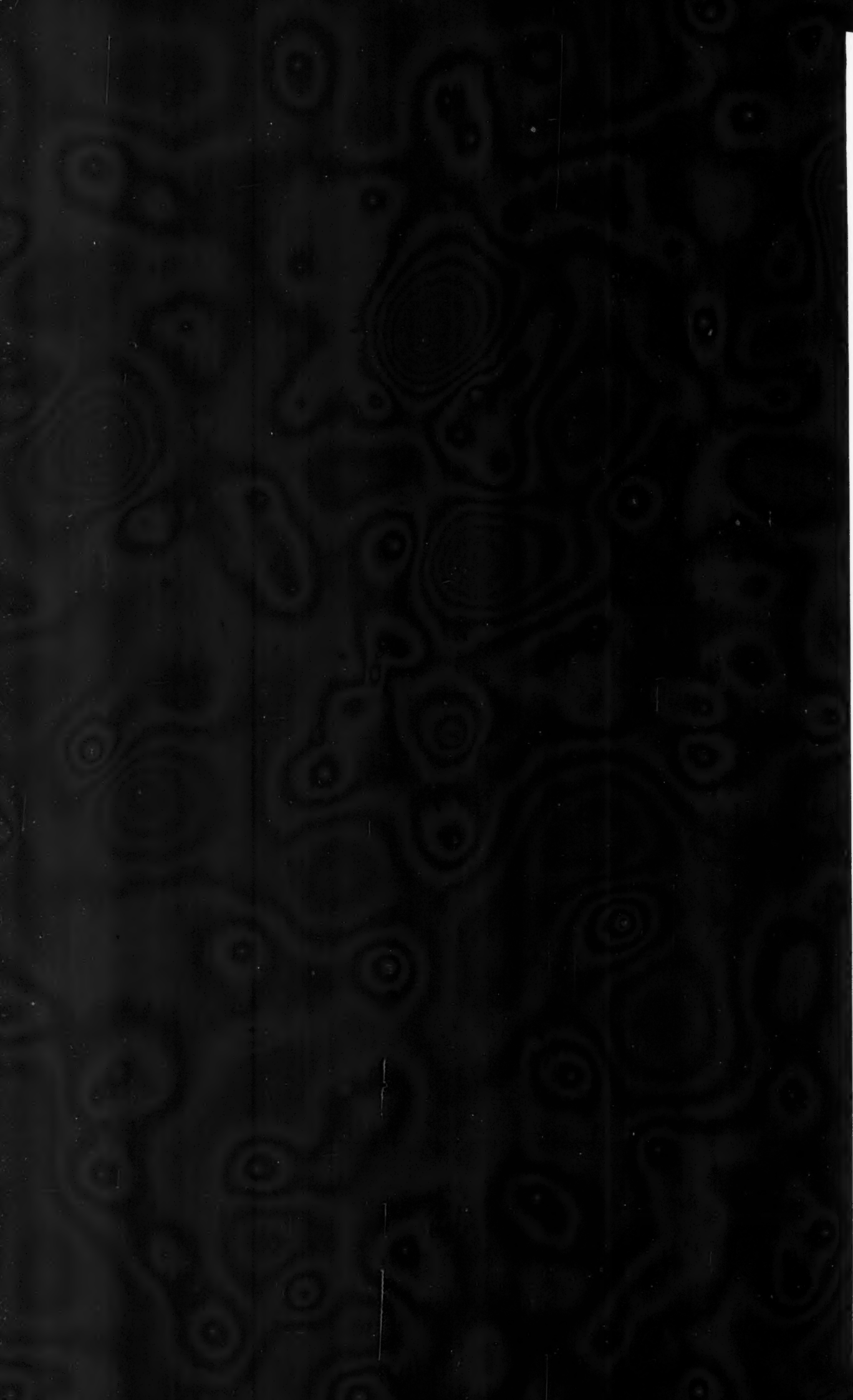
Winsford.—Communal domestic shelters (£5,642); P. Heaton, surveyor, Town Hall.

Wood Green.—Shelters (£3,452); Ernest Knifton, Ltd.

Worcestershire. — School, Chadwick's estate, Rubery; H. Rowe & Son, acting county architects, 38, Foregate Street, Worcester.

Worksop.—Public shelters (17); borough engineer, Park House, Worksop.

York.—Completion of Water Lane School; city architect.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ELECTRICAL REVIEW

FOUNDED 1872

Vol. CXXVII. No. 3284 NOVEMBER 1, 1940 SIXPENCE

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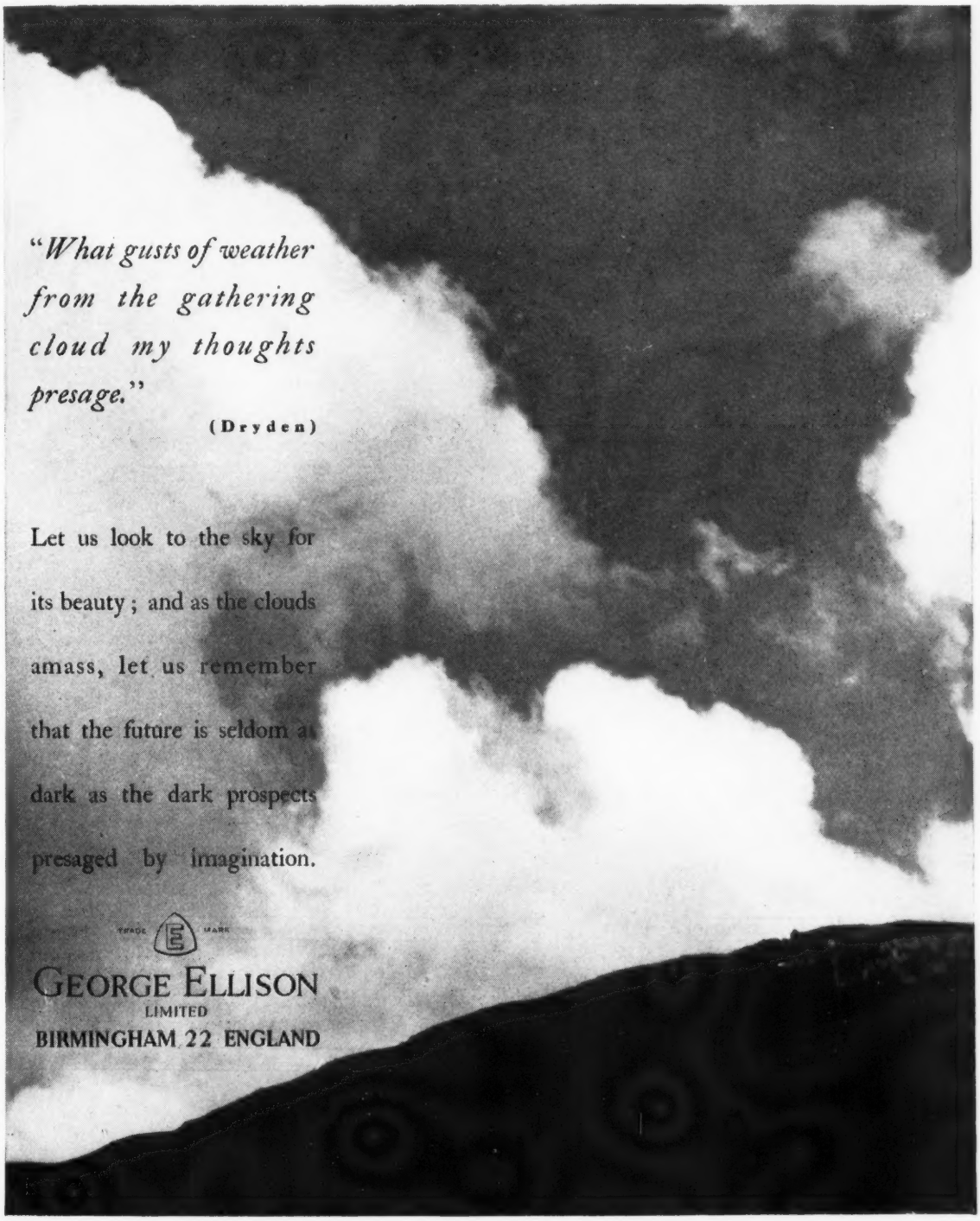
"What gusts of weather from the gathering cloud my thoughts presage."
(Dryden)
Let us look to the sky for its beauty; and as the clouds amass, let us remember that the future is seldom as dark as the dark prospects presaged by imagination.
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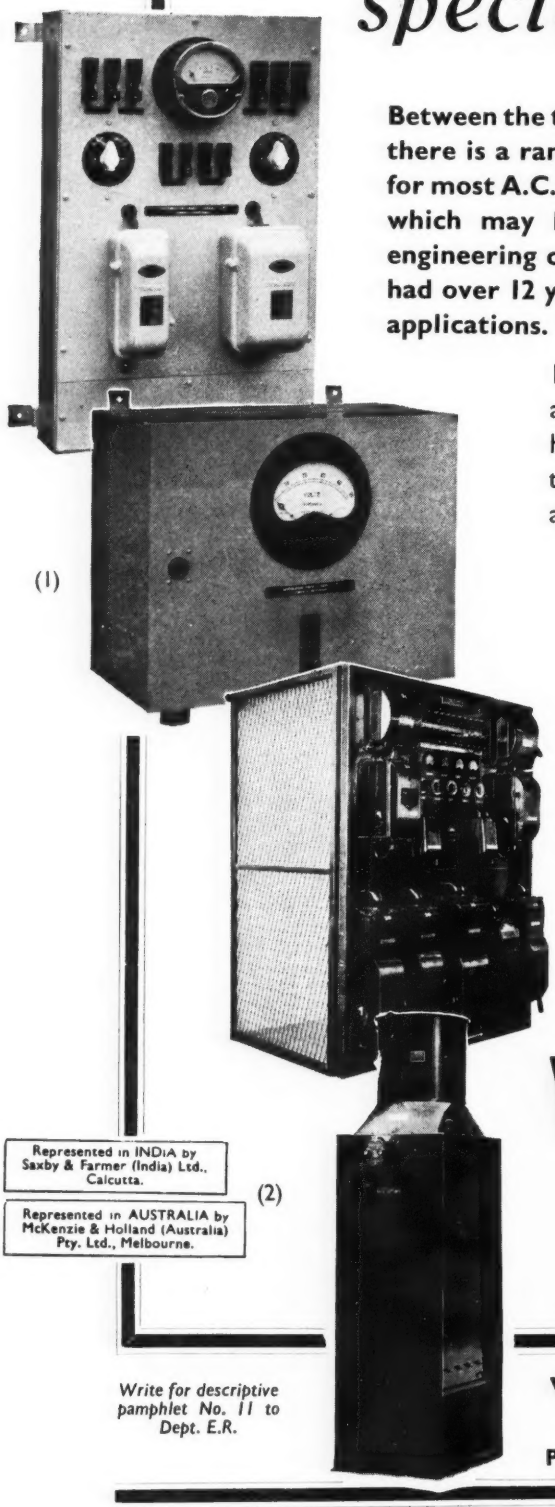
TWO *special applications*



(1)

(2)

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1. This is a special emergency lighting rectifier and control panel. The charger (top illustration) has an output of 50 volts, 12 amperes, and is used to charge an emergency lighting battery, which also controls numerous tripping and other circuits.

2. The bottom illustration shows a 230-volt, 25-ampere charger supplied to a Power Station. Normally, the rectifier "floats" a battery which is used to operate emergency lighting, indicator lamps, etc., and the panel is used to control the operation of 42 circuit-breakers, each taking 23kW, from two short-time-rated metal rectifiers. In the event of a mains failure, however, the operation of the circuit-breakers is by means of the battery.

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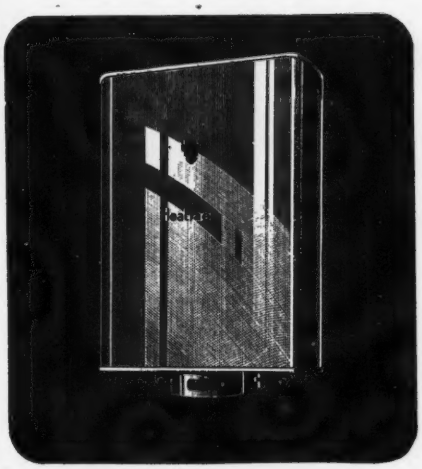
Comparison



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To-day, Heatrae Electric Water Heaters can truly claim to have wrought a miracle in getting Water HOT to the correct degree without either the Householder or Power Supply Authorities being BOTHERED in the *least* degree.
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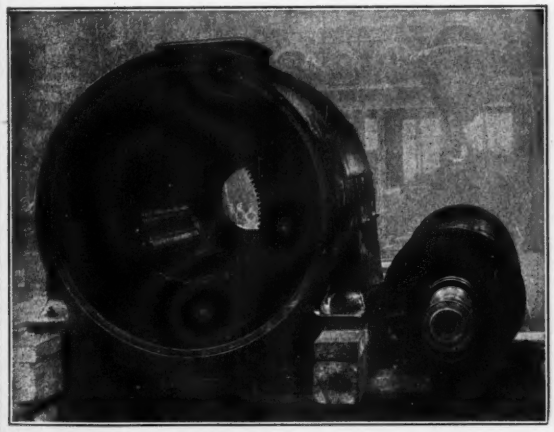

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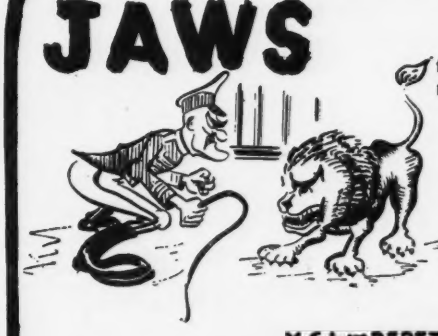
JAWS



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for hot water appliances, armatures, and any soldered joint to resist temperatures of over 100° C. (212° F.).

Number	Melting Range	Brinell Hardness at 15° C.	at 100° C.	at 180° C.
H.T.3	235/240° C.	10.3	5.45	3.0
L.S.1	305/312° C.	7.1	5.35	3.0
L.S.2	305° C.	7.1	4.95	3.0

FUSIBLE SOLDER

Grade	Melting Temperature C.	F.	Grade	Melting Temperature C.	F.
Fry's No. 2 Alloy	70°	158°	Fry's Tube Bending Alloy	71°	160°
Fry's No. 9 Alloy	93°	203°	Fry's Alloy for Die and Punch Mounting	120°	248°
Fry's No. 15 Alloy	138°	281°			
Fry's No. 17 Alloy	124°	256°			

DIPPING SOLDERS

Grade	Melting Range	Using Temperature	Weight: lb./cu. in.	Weight: lb./cu. ft.
T.R.	183/210° C.	280/300° C.	0.32	552.96
No. 1	183/230° C.	310/330° C.	0.338	584.0
2	183/255° C.	330/350° C.	0.325	608.256
3	183/290° C.	340/400° C.	0.372	642.816

TINMAN'S SOLDERS

Grade B.S.S.	Melting Temperature	Tensile Strength: tons/sq."	Elongation %	Brinell Hardness
A	185° C.	4.9	20	13.9
B	205° C.	4.4	67	12
C	230° C.	4.1	63	11.3
D	255° C.	3.8	53	8.7
F	210° C.	3.8	69	12
K	185° C.	4.0	52	13.9

Further details, samples, technical leaflets and metallurgical advice on request

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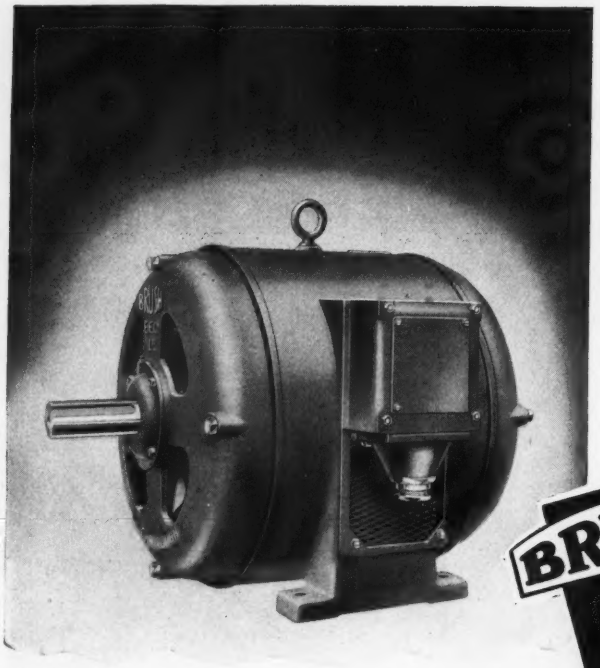

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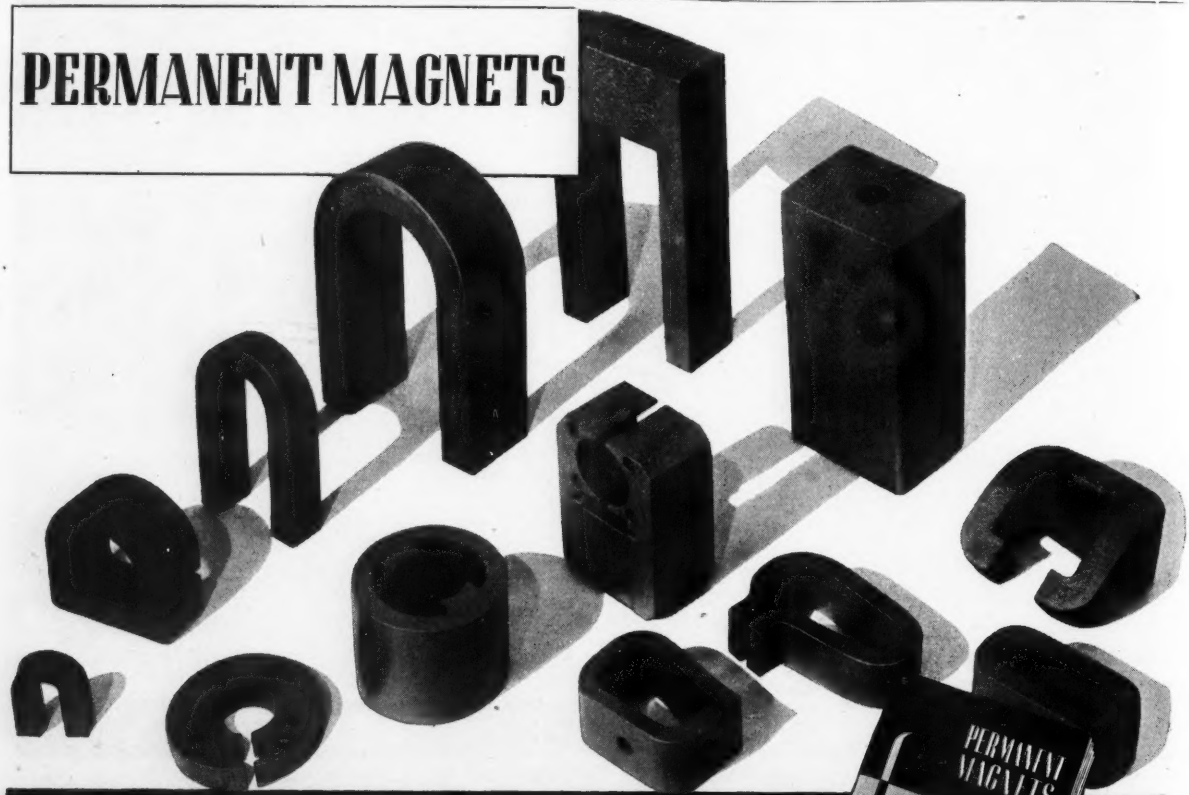

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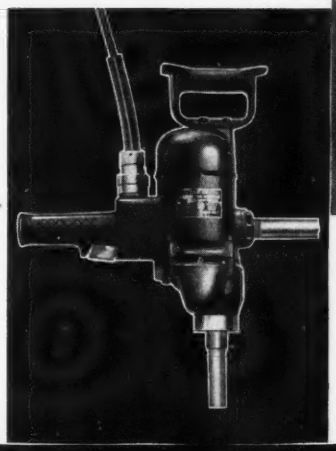

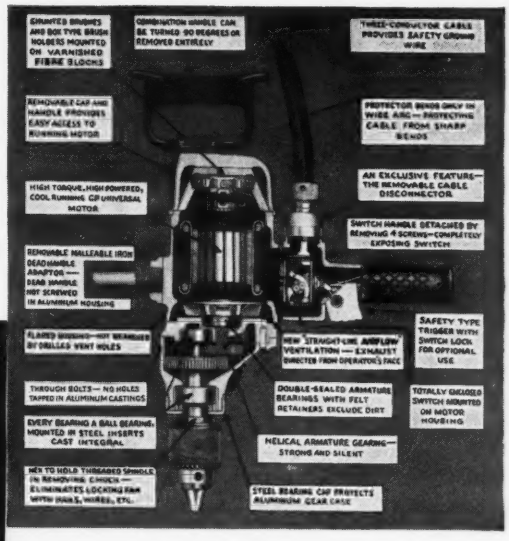
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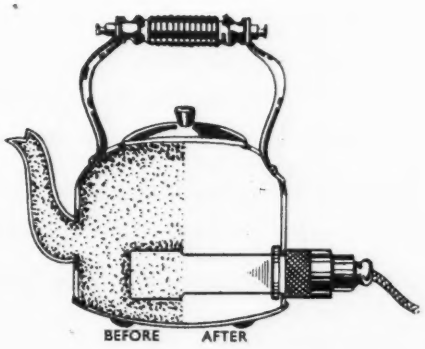

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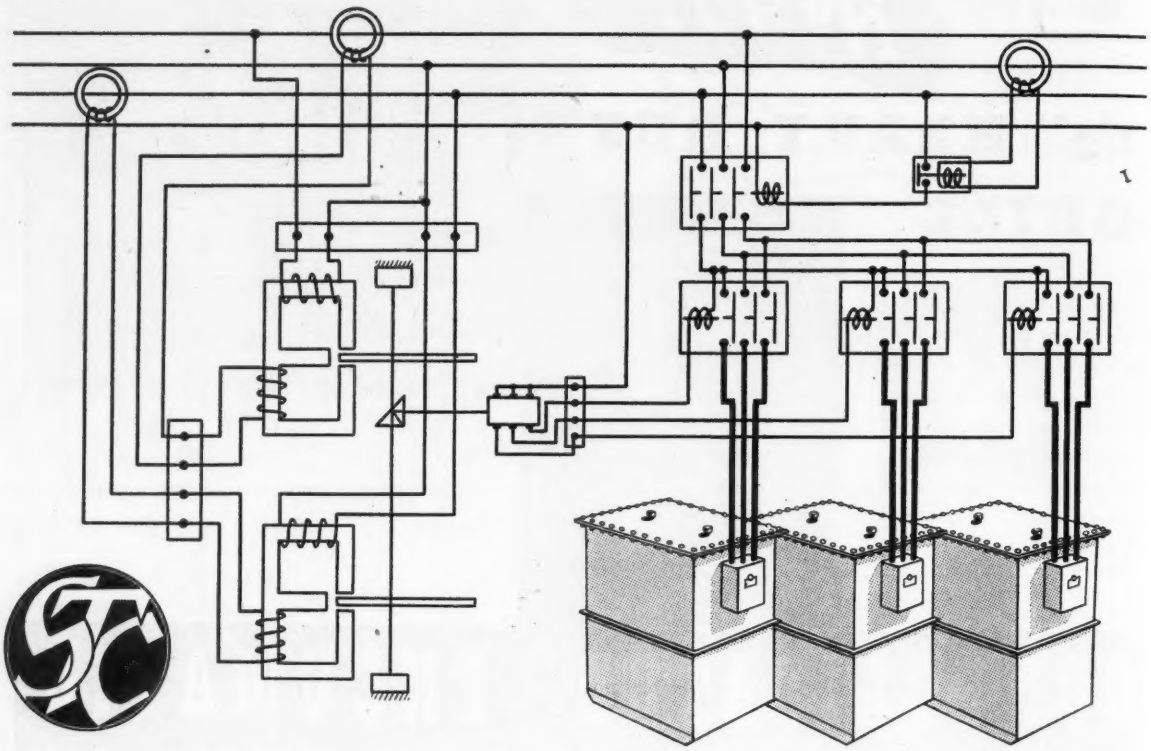

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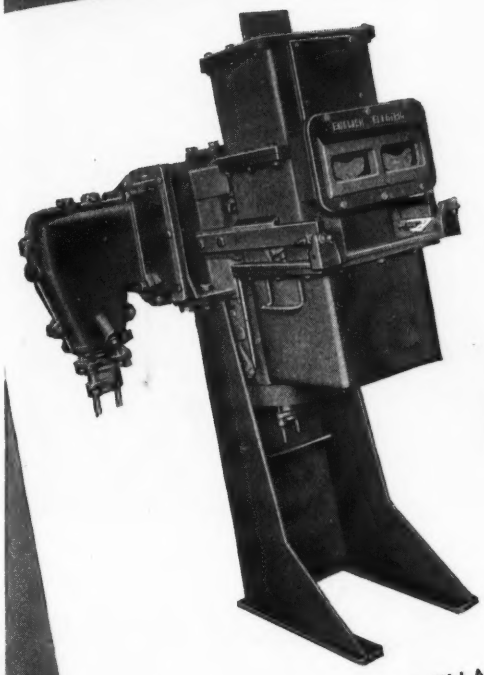
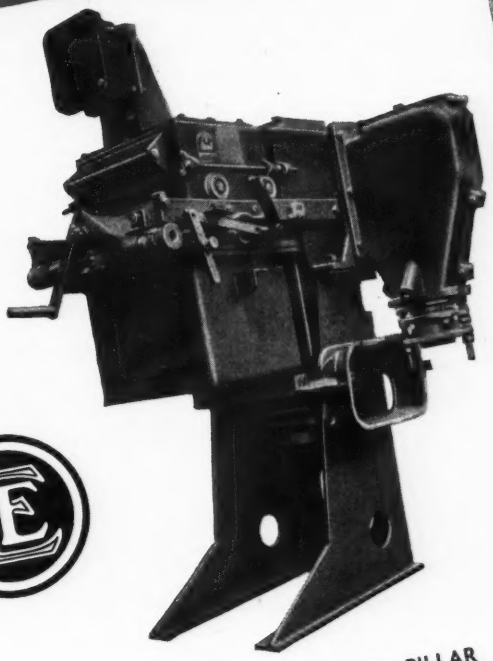


TYPE OLA.1 SWITCH PILLAR
Maximum Ratings : 3-3KV., 150 Amps., 650 Volts, 300 Amps.



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With leakage relay on top, and detachable tank lowering gear in position.
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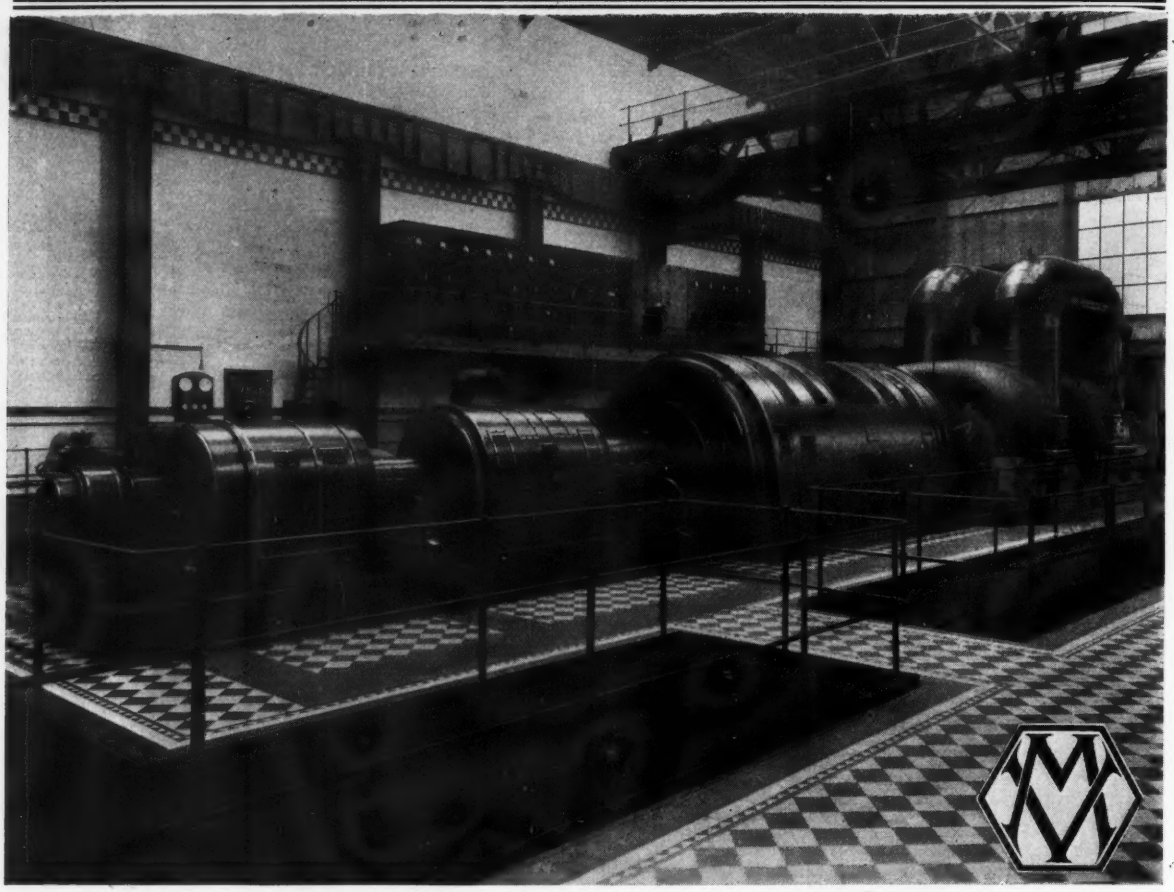

The photograph shows a 31,250 kW 3,000 r.p.m. "Metrovick" 2 cylinder type Turbo-Alternator Set installed with "Metrovick" Condensing Plant.

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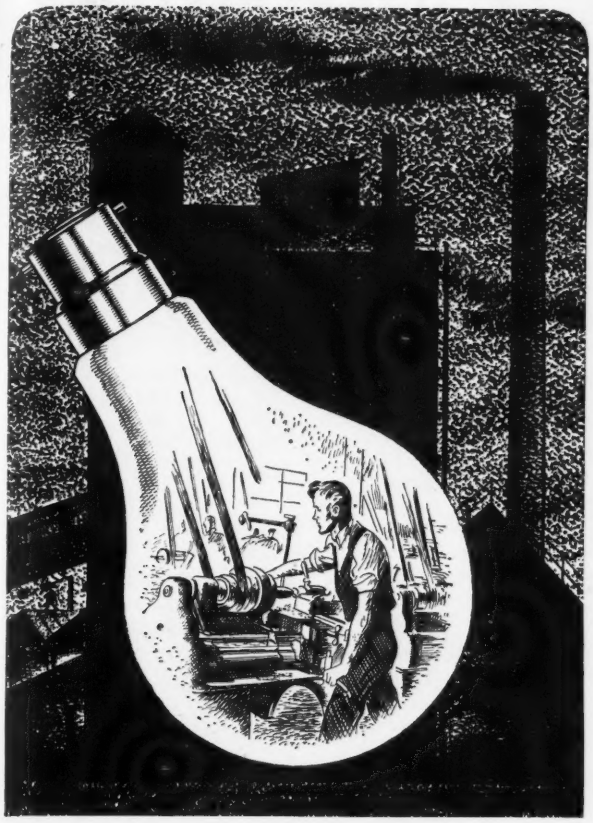

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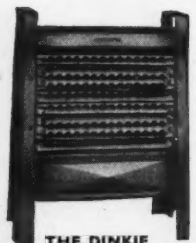

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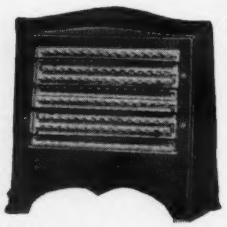

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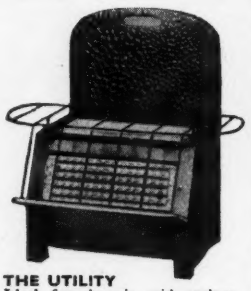

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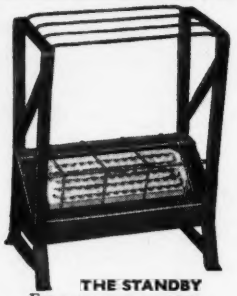

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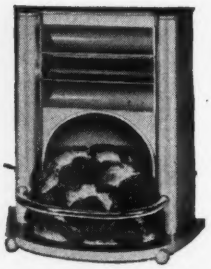
2 kW. As illustrated but Reflector type only - - - 65/-



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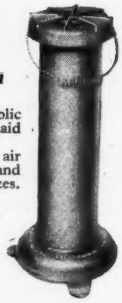

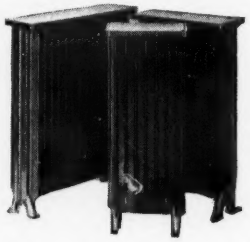

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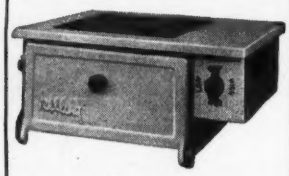

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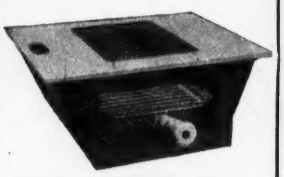

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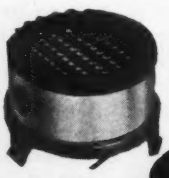

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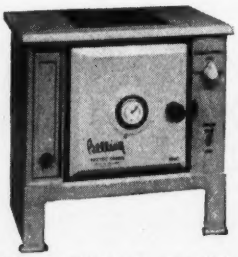

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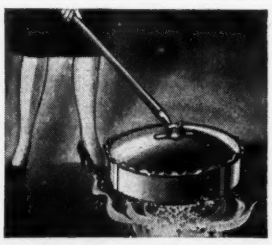

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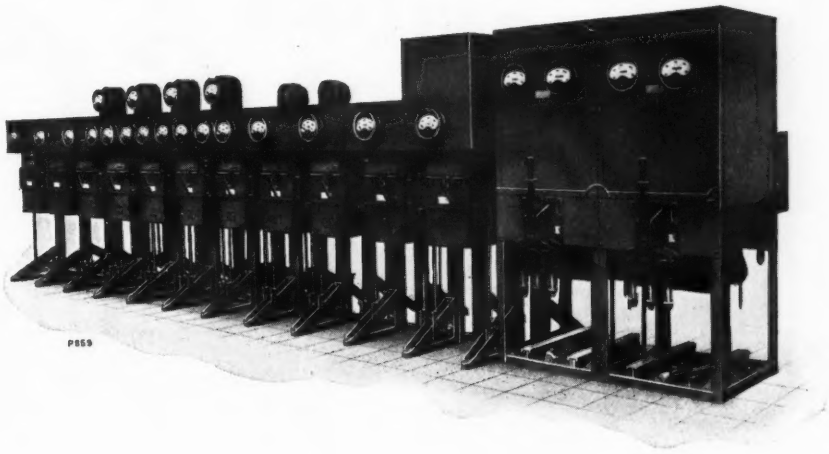

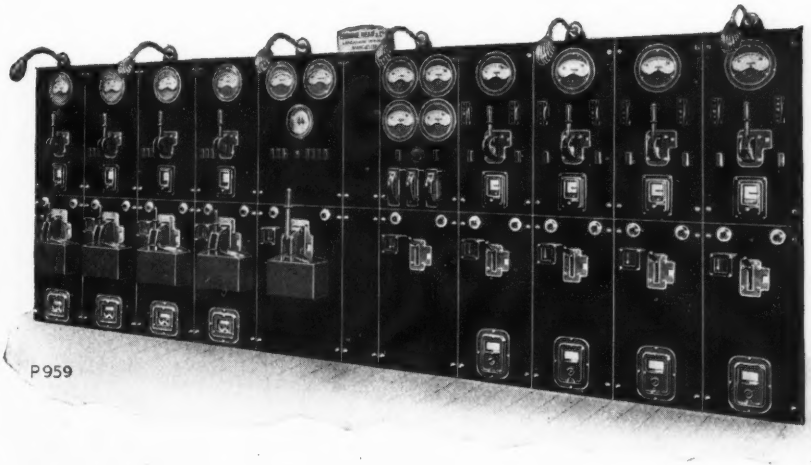

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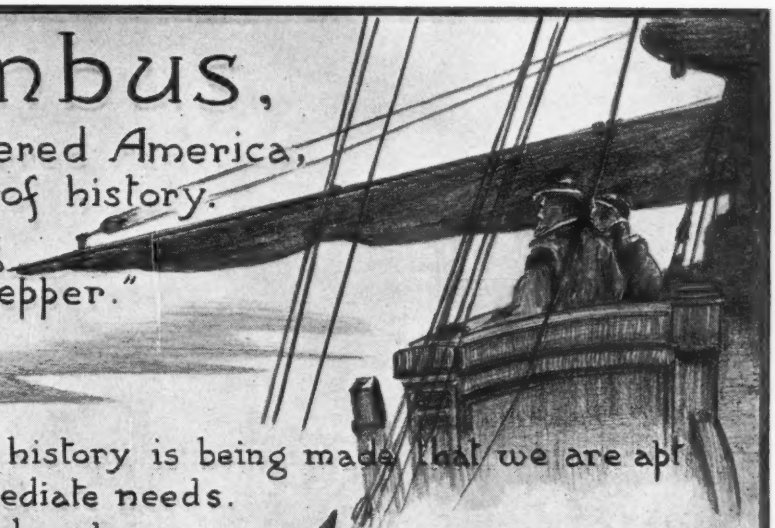
when he discovered America,
was not thinking of history.
He was looking
for nutmegs and pepper."
(J. P. Kennedy).



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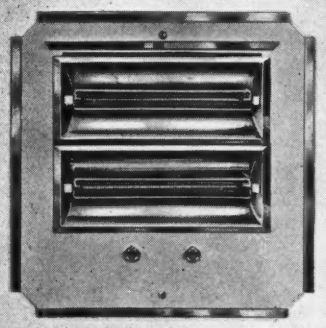
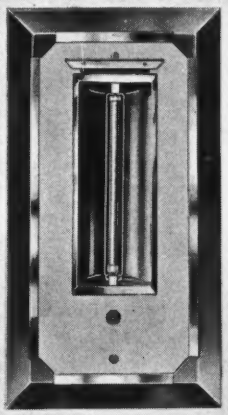
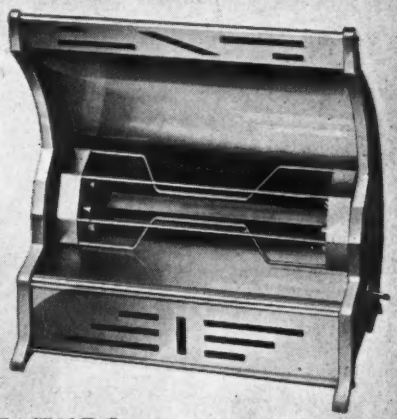
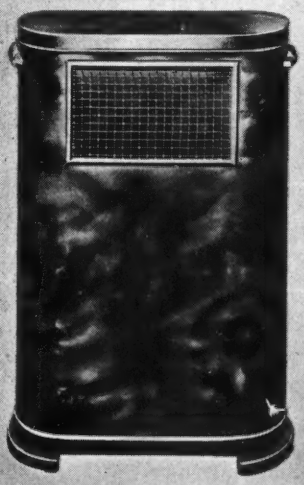


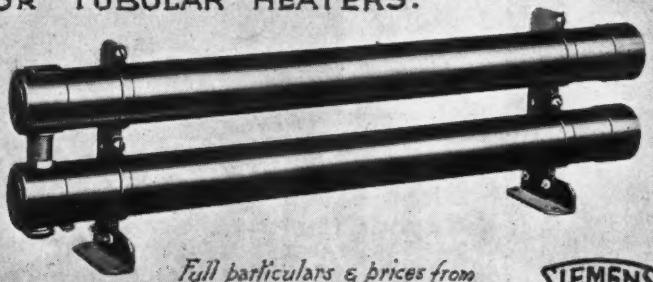




CONVECTORS,



OR TUBULAR HEATERS.



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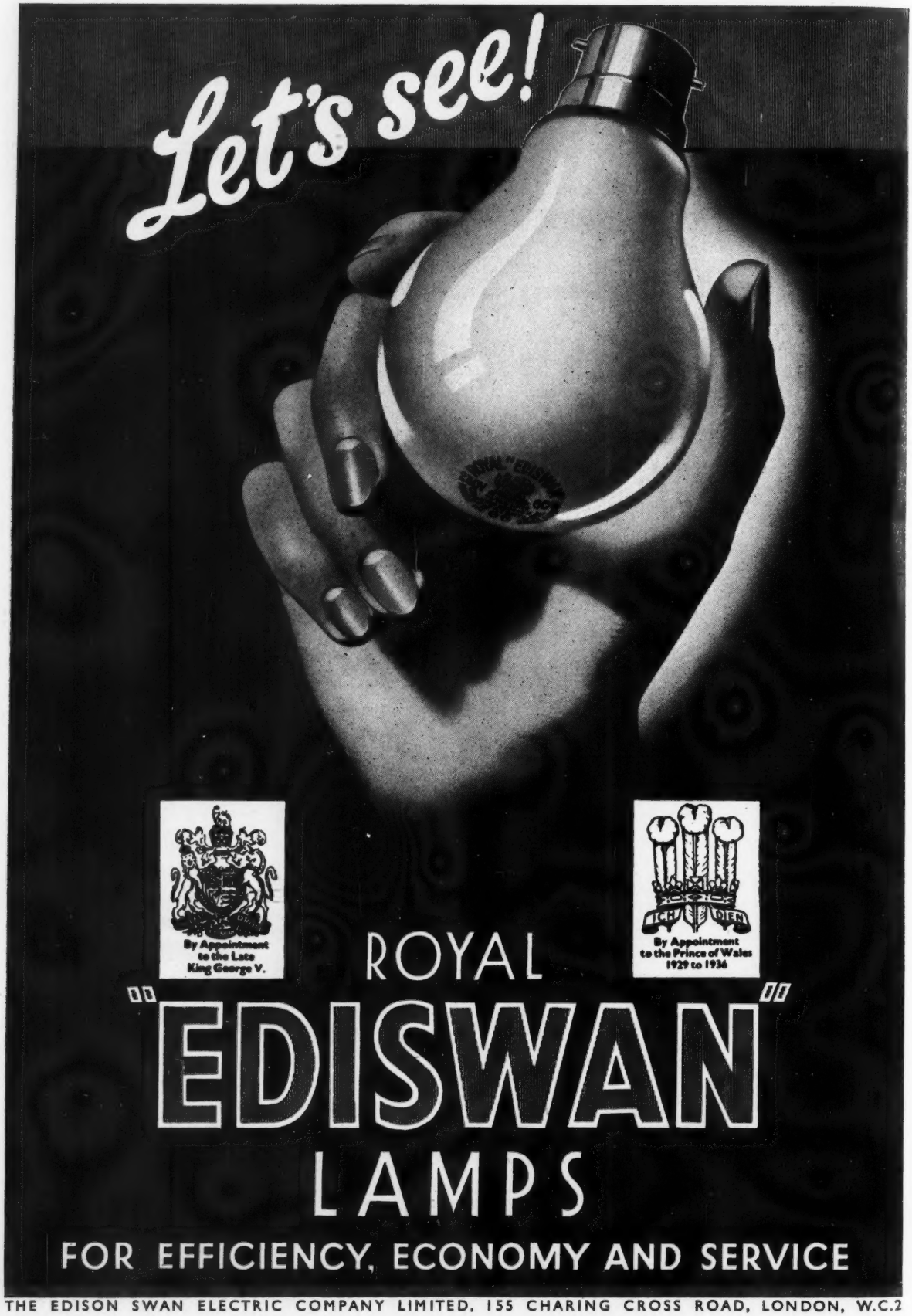

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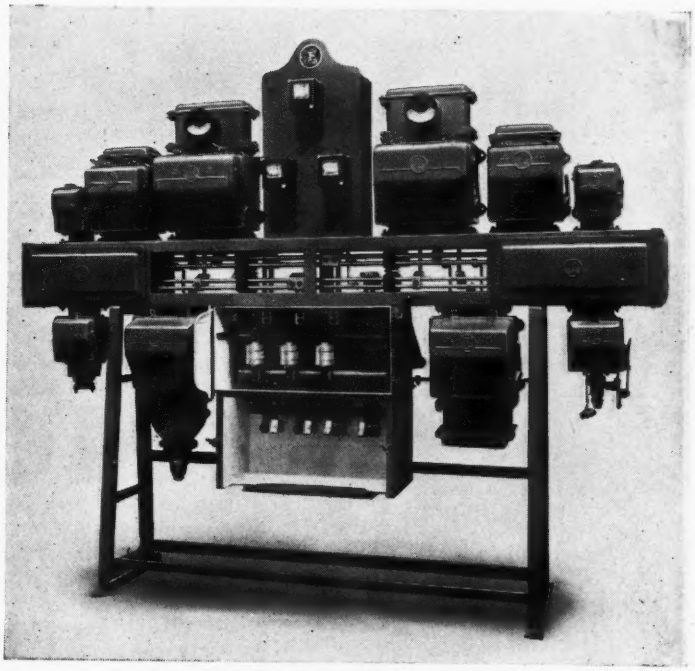

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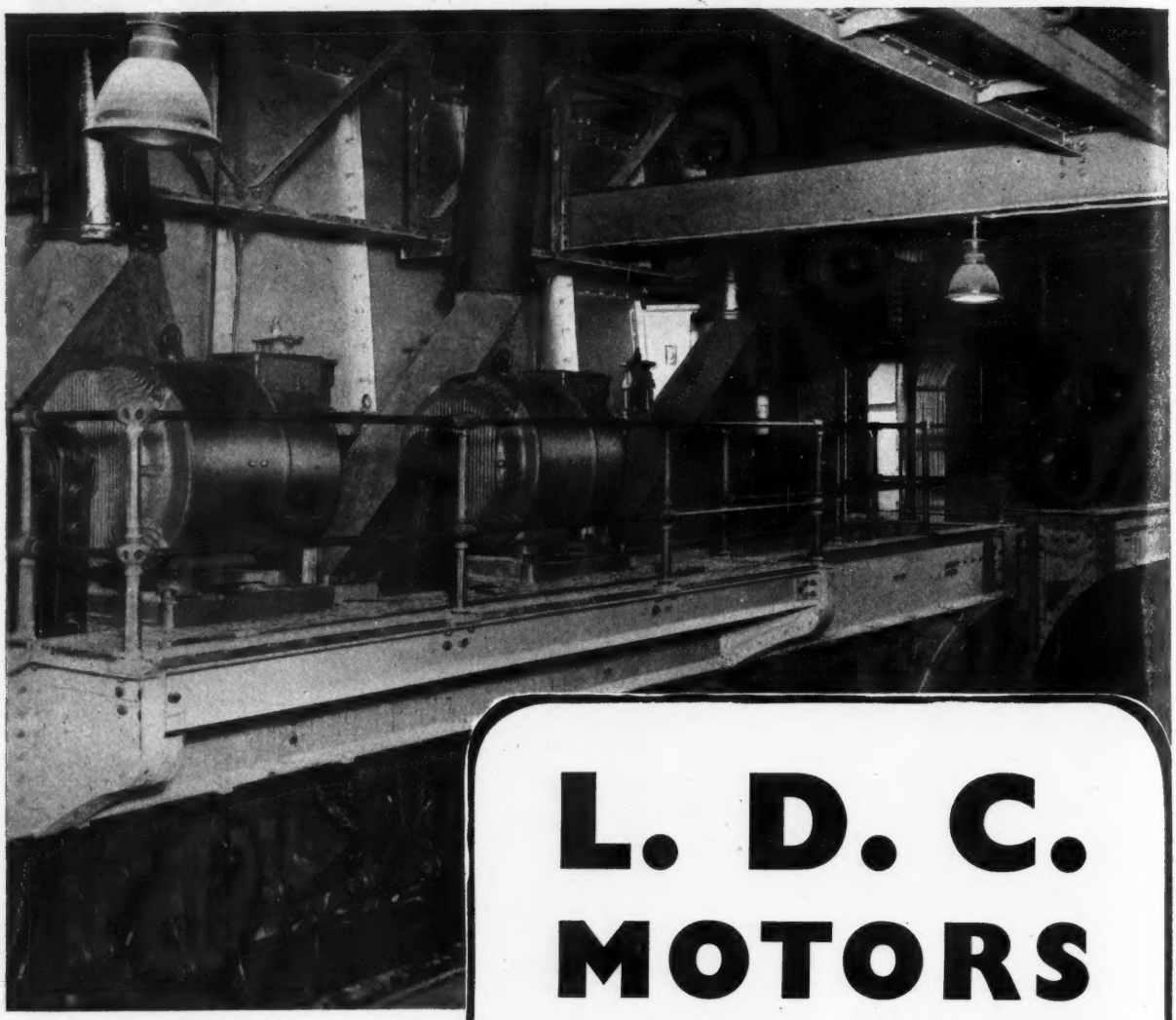

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S 11232

CONTROLLER FOR 9 LIGHTS OFF MAINS, OR 5 LIGHTS OFF BATTERY
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S11050. Designed for general Air-raid Shelter Lighting control. Galvanised case houses transformer with low voltage output to feed 9 points of 10 watts each at 12 volts. Changeover switch provides either 2 circuits of 5 or 4 points mains fed, or 5 points battery fed. Four 15 amp. S.P. Fuses, and three 5 amp. switches for main and sub-circuit control.

CONTROLLER FOR 2 OR 4 LIGHTS AND HANDLAMP OFF MAINS OR BATTERY
Conforming to Specification BS/ARP 26

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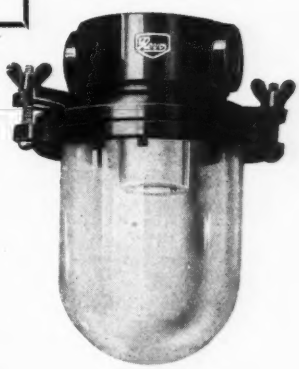
C 11038 NP



C 11074

C 11042 NP

C. 11038 NP
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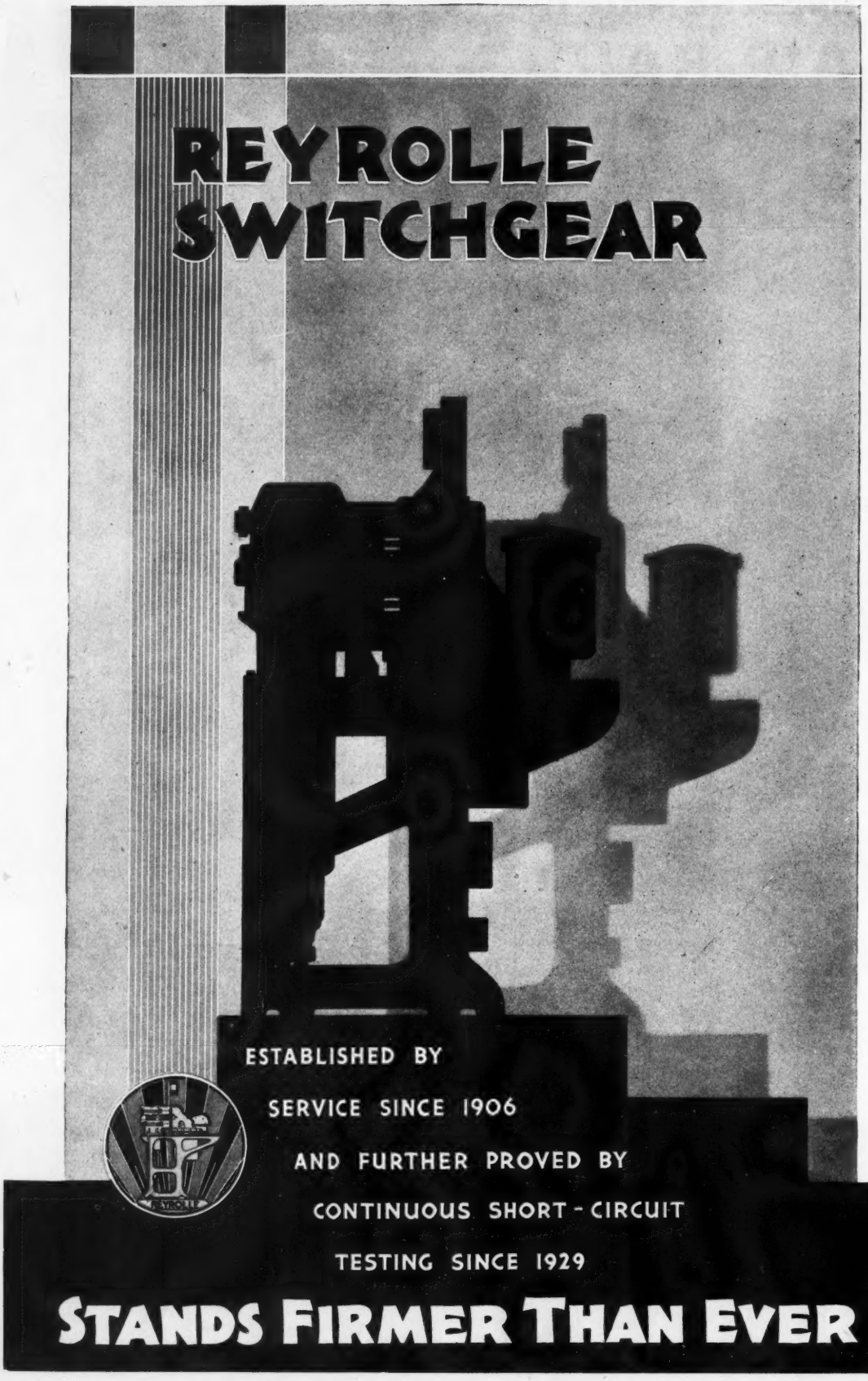
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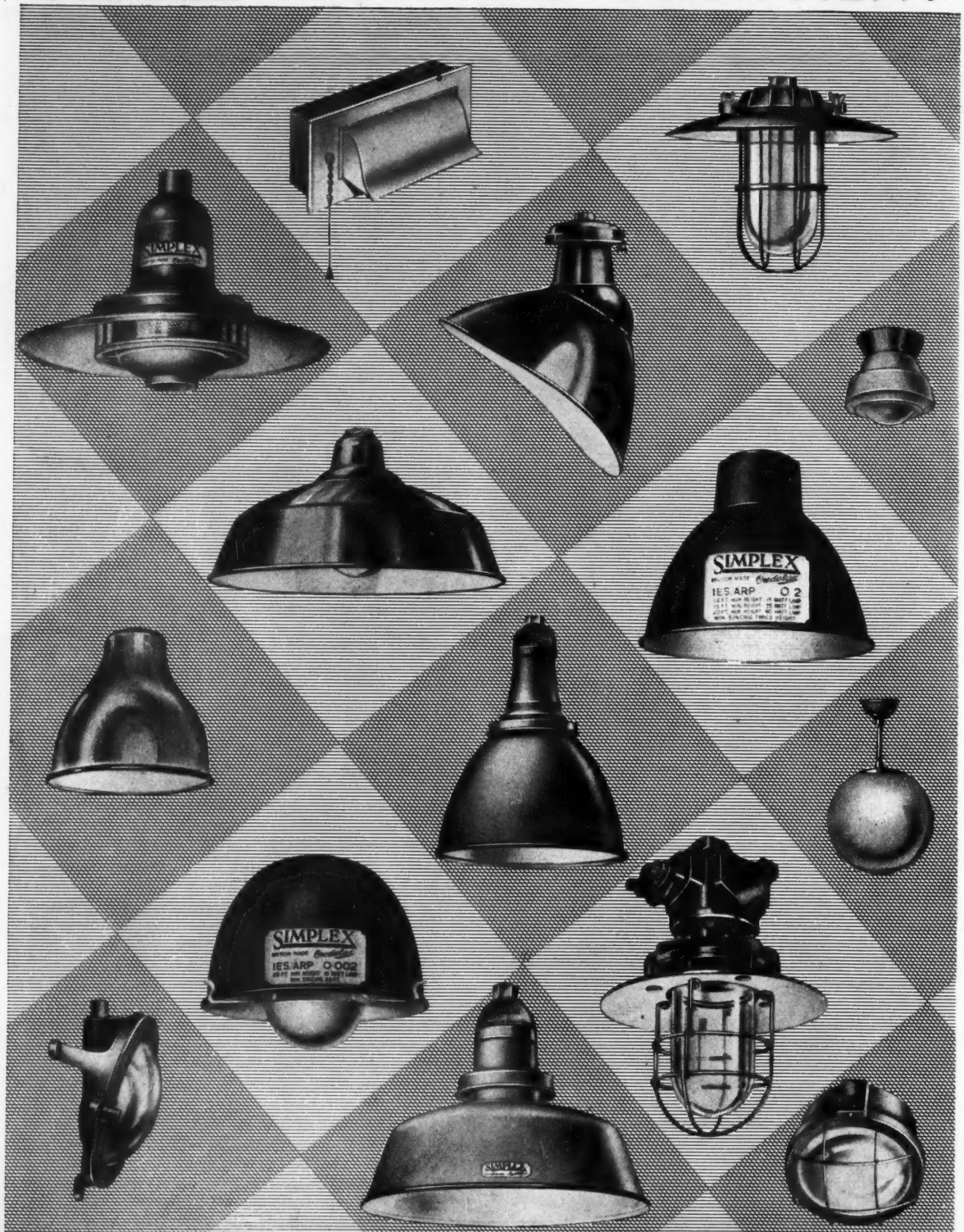

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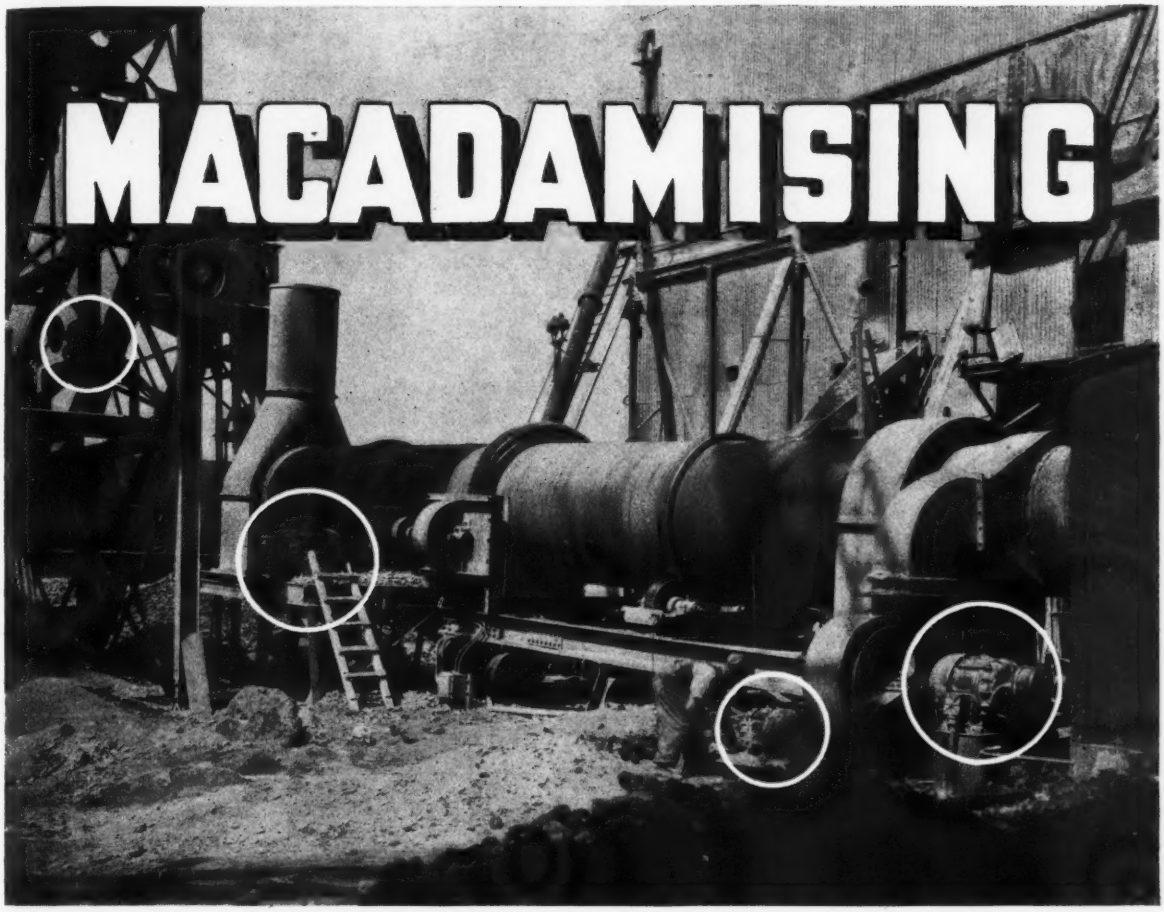

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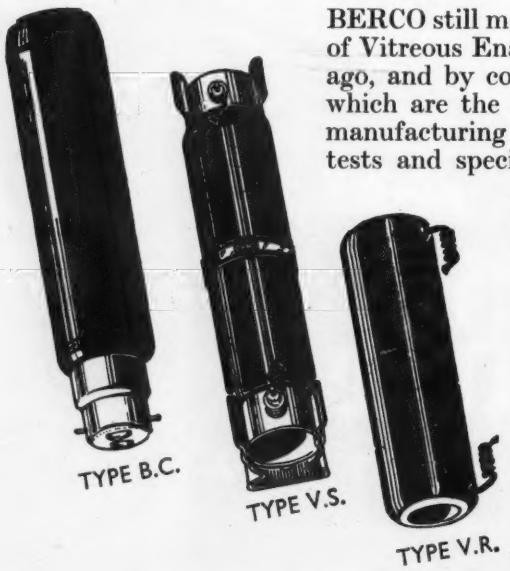

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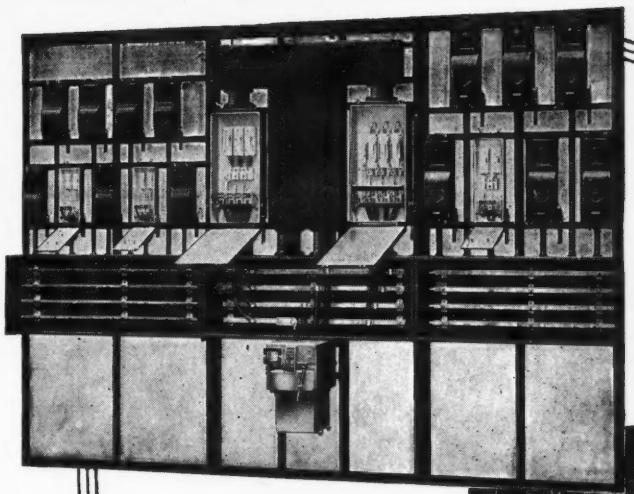

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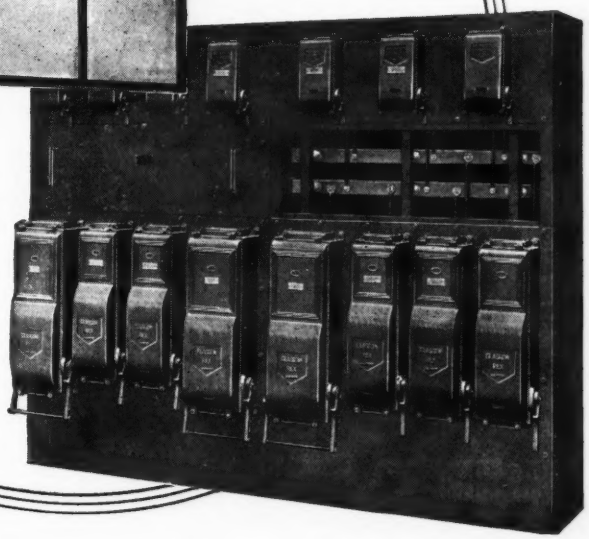

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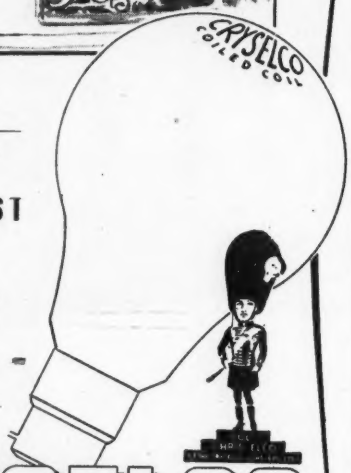

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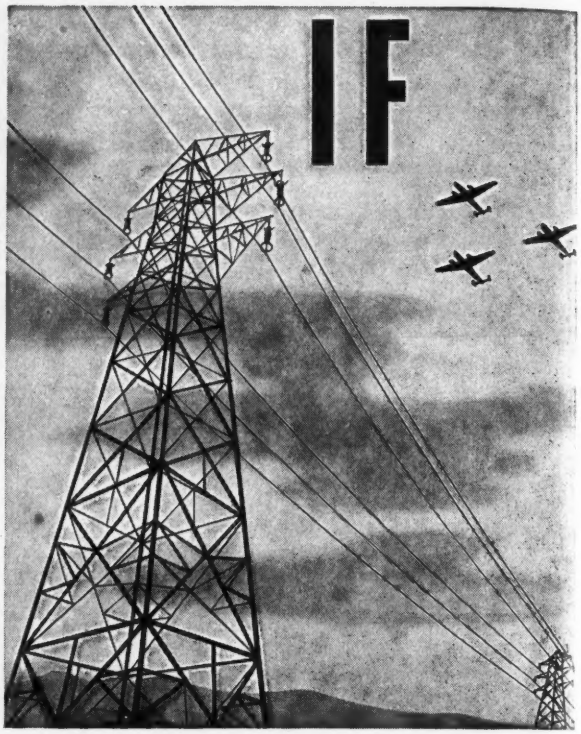

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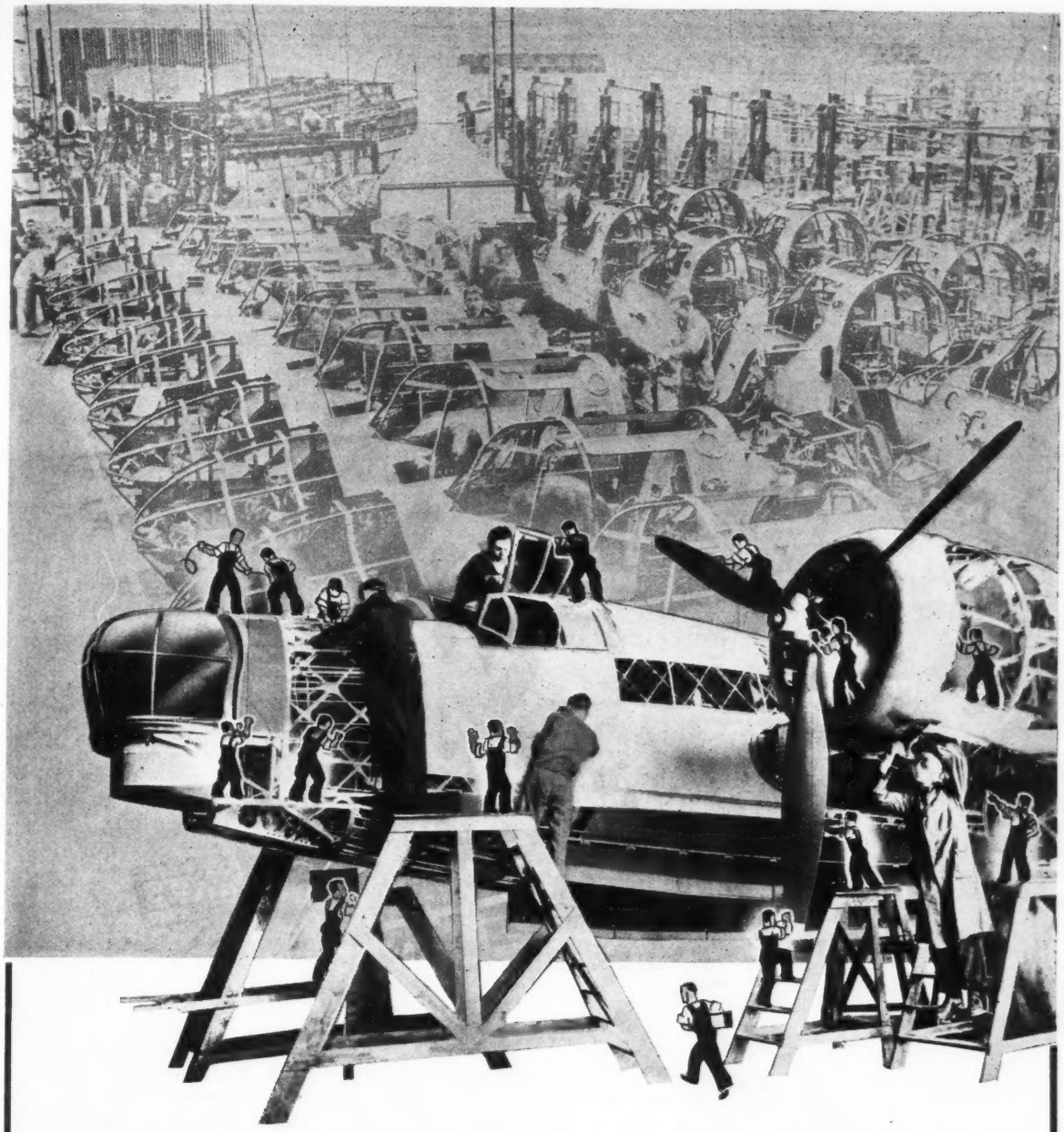

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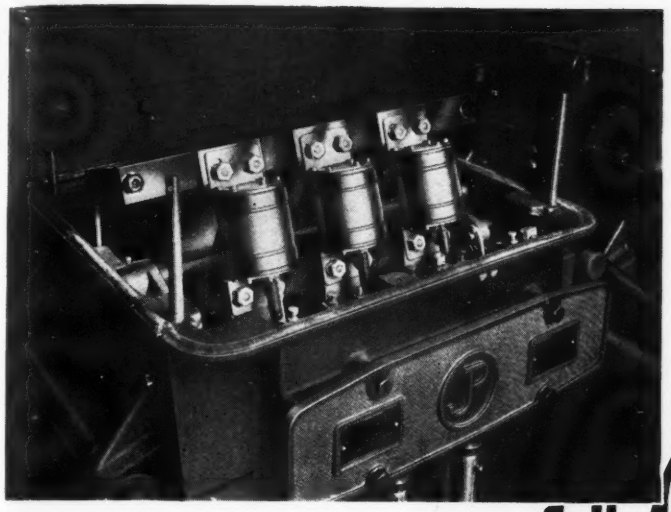

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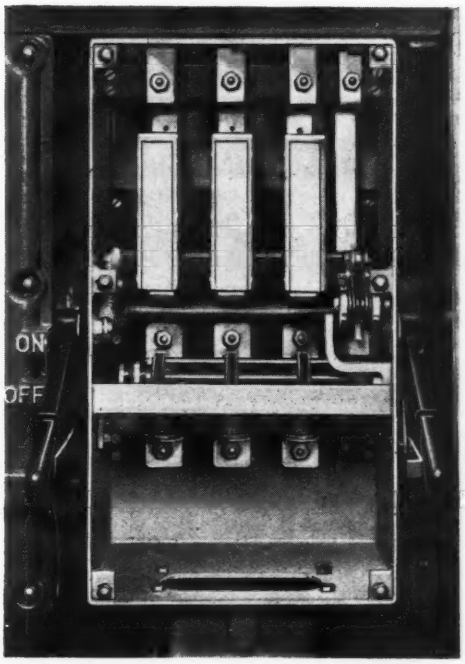

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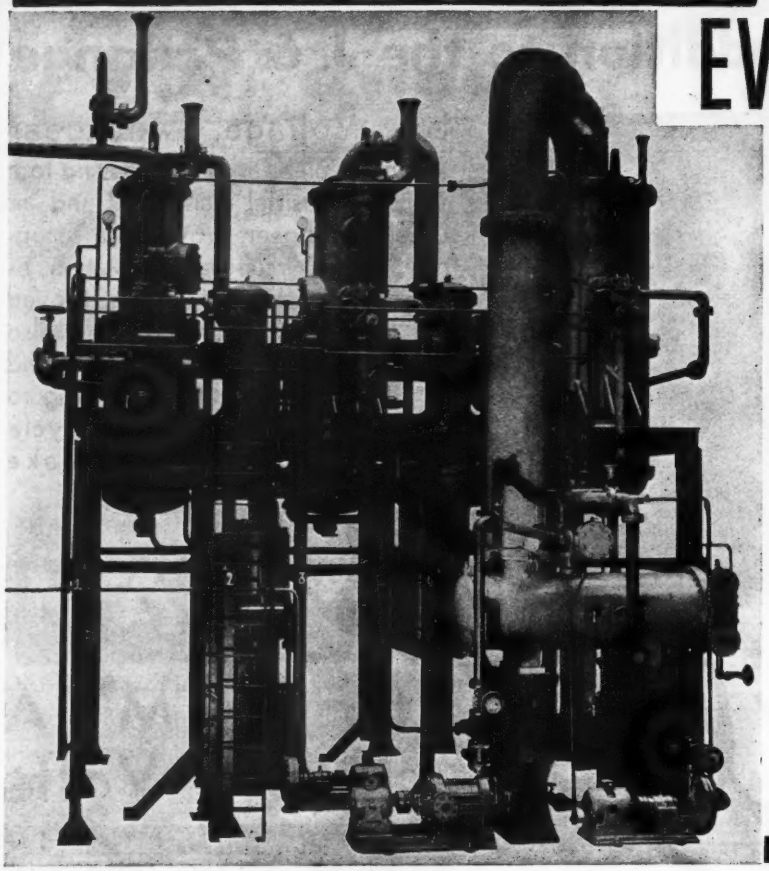

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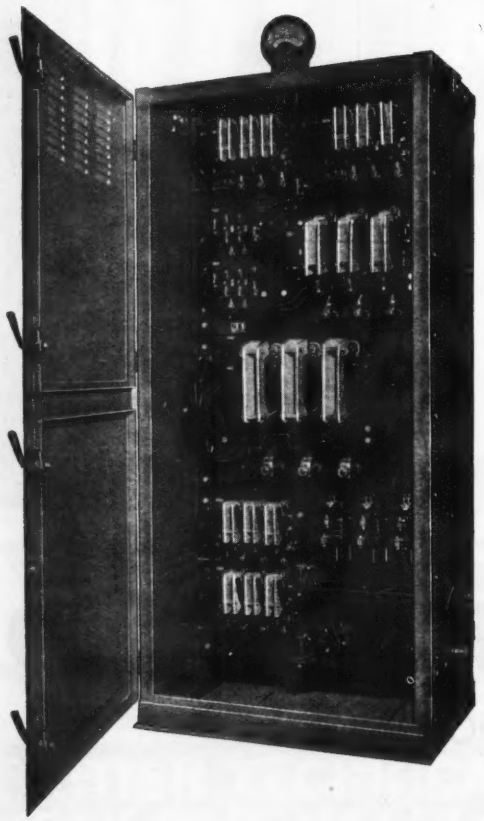
Telegrams : "HICK, BOLTON"

AD 58



'IGRANIC' *Electric Control Gear*

FOR THE SAFE AND EFFICIENT CONTROL OF ALL CLASSES OF ELECTRICALLY DRIVEN MACHINES

The high degree of reliability of Igranic Control Gear provides a degree of Satisfaction yet to be equalled. Gives positive protection to expensive machinery, yet capable of withstanding the most arduous duty.

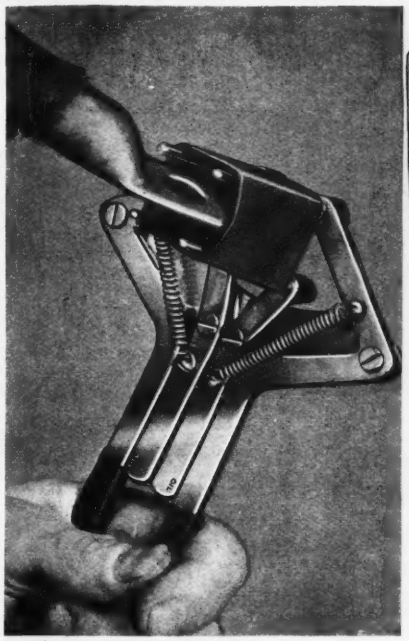
CONTROL GEAR BUILT TO INDIVIDUAL REQUIREMENTS

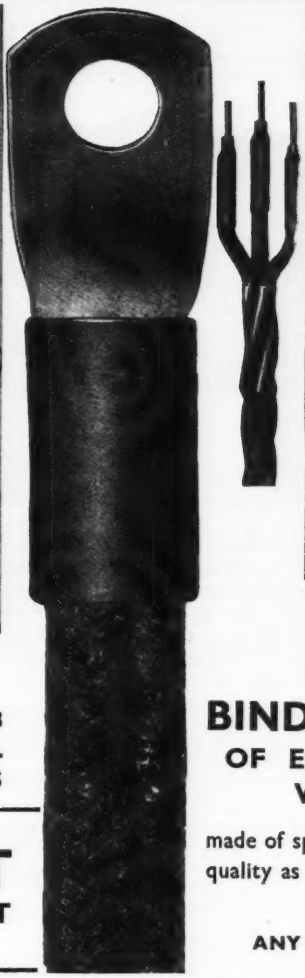
Illustration shows Igranic type No. 1080 starting panel for 250 h.p. 400 volt motor for Steel Mill duty

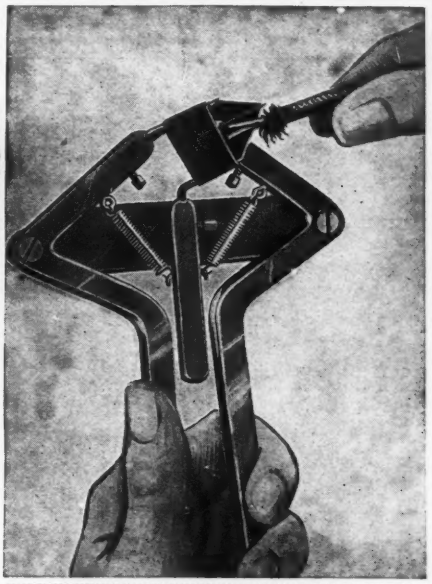
COMPANY IGRANIC ELECTRIC LIMITED

149 Queen Victoria St. LONDON

Works : BEDFORD







3 PRONG HAND TOOL 25/-
3 PRONG BENCH TOOL 35/-
for all sizes of cables from ·075—·75

NEW!

FIRST 2 — — THEN 3
NOW **A 4 PRONG TOOL**
FOR VERY HEAVY CABLES

Write for particulars to

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39 BERNERS STREET
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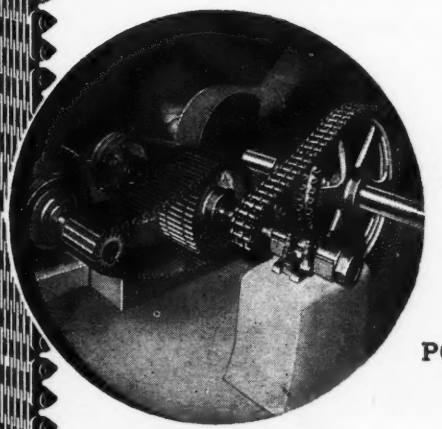
BINDING and INSULATING
OF ELECTRICAL CONDUCTORS WITH RUBBER TUBES

made of special mineralised rubber. Non-perishable quality as supplied since 1935 to Air Ministry, War Office, Admiralty, etc.

ANY QUANTITY, SIZE AND COLOUR FROM STOCK

One good chain deserves another



Though the war has to come very much first, we always do our best for customers when replacement arises. Not, of course, that replacement arises very often amongst Morse Chain users!

POWER TRANSMISSION SPECIALISTS

THE

MORSE CHAIN

CO. LTD., LETCHWORTH AND BUSH HOUSE, LONDON

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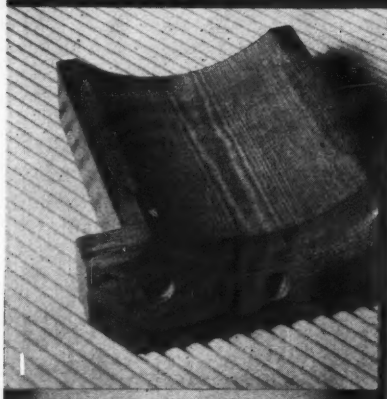
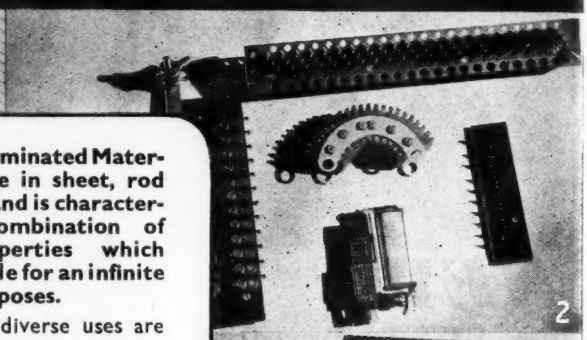
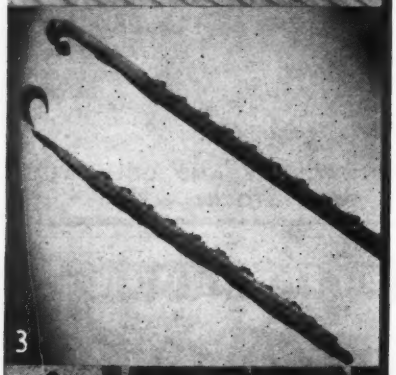
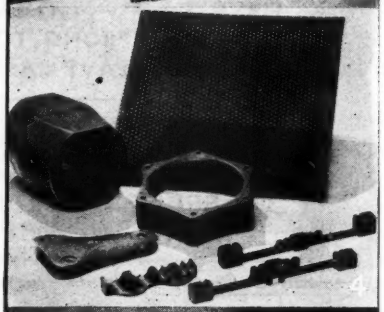
BAKELITE
Laminated Material









BAKELITE Laminated Material is available in sheet, rod or tube form and is characterised by a combination of physical properties which make it suitable for an infinite variety of purposes.

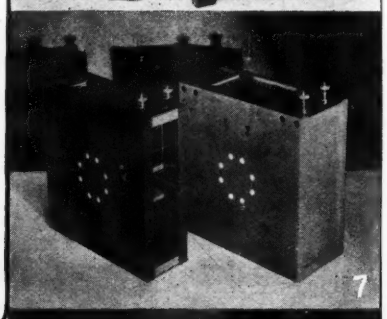
A number of diverse uses are illustrated:

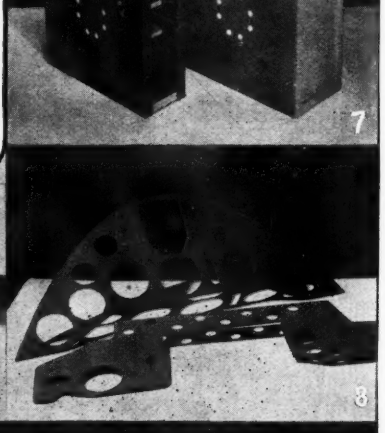
(1) a rolling-mill bearing
(2) telephone exchange components
(3) electro-plating hooks; one surfaced with BAKELITE Laminated Material and other without
(4) aircraft components
(5) electrical punchings
(6) aircraft pulleys
(7) Sullivan Griffiths inductance standards
(8) aircraft instrument panels.

There are more than 50 grades of BAKELITE Laminated Material, many of which meet Admiralty, War Office, Air Ministry, Post Office and B.S.I. specifications.

Technical data sheets on all principal grades are available to customers.

BAKELITE
Registered Trade Marks
TREFOIL





BAKELITE LIMITED · BRACKLEY LODGE · BRACKLEY · NORTHANTS

Telephone: Brackley 144 (4 lines) Telegrams: "Bakelite, Brackley" Works: Birmingham (Established 1910)
London Office: 18 Grosvenor Gardens, S.W.1. Telephone: Sloane 9911

THE MATERIAL OF INFINITE USES

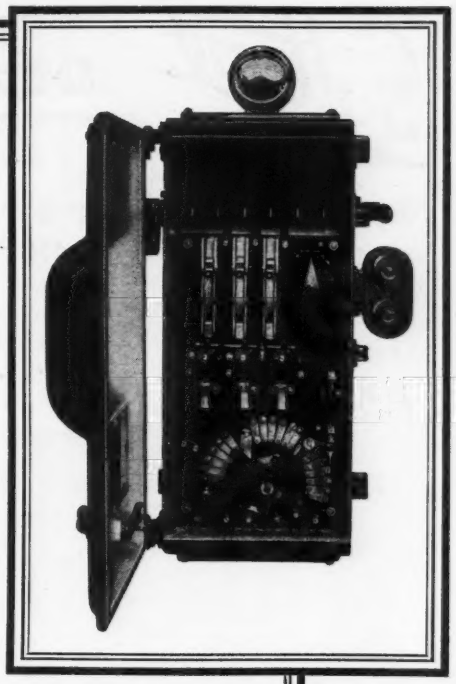
CONTROL

FOR

SLIP RING

MOTORS

The illustration is of an Air Break Combined Rotor Starter and Regulator, with Contactor Switch for the stator, also Interlocked Isolator, all combined in one case



VERITYS LTD

ASTON, BIRMINGHAM 6

Sales Headquarters :
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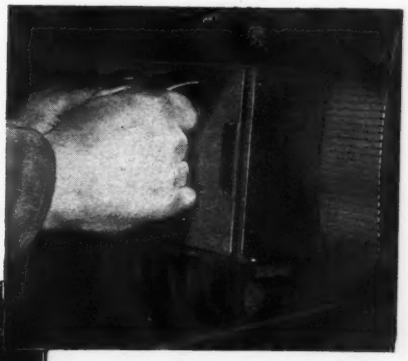
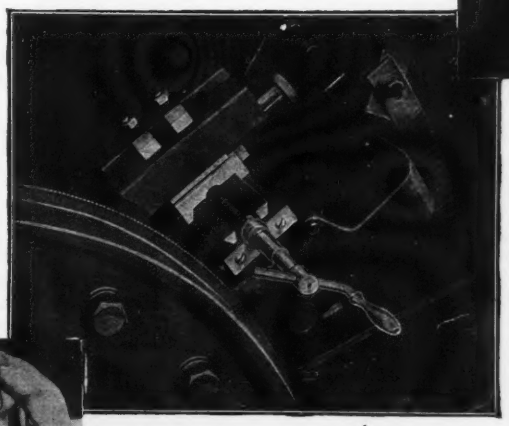
Martindale COMMSTONES for truing Commutators

In regular use by over 25,000 customers all over the world. Cut copper, brass or steel without clogging, and leave the edges of every bar clean—no dragging of copper. Increase plant efficiency. Prolong the life of motors and generators and save from 75% to 95% of the time and cost of turning a commutator in a lathe.

Ask for Bulletin No. 81.



(Above)
Hand-operated Martindale Commstone—Over 50 stock sizes — 3 grades, coarse, medium, fine—20 different types of handles.



(Below)
MARTINDALE COMMSTONE HOLDER.
Grinding small Commutator.

(on Left)
Martindale Commutator Grinder mounted on 1,500 kW Rotary.

Increase Your Plant Efficiency, Prolong the Life of Your Motors and Save Your Time by using Martindale Maintenance Equipment.

MARTINDALE

ELECTRIC CO. LTD.
Westmorland Road,
LONDON, N.W.9.

E

"Goltone" REGISTERED

Dependable PRODUCTS

Listed below is a range of "GOLTONE" products, the results of 48 YEARS' experience in the manufacture and supply of requirements for the Home and Overseas markets

YOUR ENQUIRIES FOR PUBLICATIONS OF OUR MANUFACTURES ARE INVITED

- **"W"** Electrical Wires, Cables and Flexible Cords.
- **"B"** Shockproof Bakelite Accessories for Electric Lighting, Heating, Power and Bells.
- **"R"** Radio Wires and Accessories.
- **"A"** Automobile Wires, Cables and Motor Car Electrical Accessories.
- **"S"** Moulded Translucent Shades.
- **"TCH"** Torches and A.R.P. Portable Lamps.

"Goltone" **FOR DEPENDABILITY**

ELECTRICAL WIRES AND CABLES

For Electric Lighting, Power and General Electrical Service. Aeroplanes, Automobiles, Tanks and Radio.

Shot Firing Cables for Colliery and Quarry use.

Armoured Conductors. Metal Screened Conductors. Telephone and Bell Wires. Metal Screened Tubings and Anti-Static Cables. Asbestos-Covered Conductors for Stoves, Radiators and Electric Fires. Fuse Wires. Lift Cables. Tough Rubber Sheathed Cables. Radio Aerial Wires.

COTTON, SILK COVERED and VARNISHED WIRES for Dynamos, Motors and Instruments.

FLEXIBLE CORDS of every description.

Specialities :

C.T.S. Flexibles.	Corrosion Resisting, Waterproof, Flexible and Durable.
"ANTISHOC"	The ideal Shockproof Non-kinking Conductor for Electric Irons and Portable Appliances.
"DUPLEX"	Flat, Non-kinking, High Insulation, for small current consuming portable appliances.
"FERAFLEX"	Heat-resisting, with Asbestos Separator.
"VARNOFLEX"	For use under conditions of extreme heat.

ELECTRICAL ACCESSORIES

For Electrical, Automobile, Radio and allied industries. Range includes Lampholders and Plug Connectors to British Standard Specifications, Ceiling Roses, Wall Plugs and Sockets, Adaptors, Portable Appliance Connectors, Electric Bells, Buzzers and Transformers, Switches, Table Lamps, Shockproof Handlamps and Auto Inspection Lamps, Radio, Automobile and Aircraft Components.

MOULDED TRANSLUCENT SHADES

Large range of White, Green and Opal and artistic colourings.

RADIO ACCESSORIES

Aerial Kits to suit all conditions. "METOCEL" Patent Anti-Static Interference Radio Down Lead. "TELESTAT" Twin Feeder Cable.
Metal Screened Tubing and Conductors. Range of Aerial Insulators with Ironwork. Morse Sounders, Tappers and Learners' Outfits.

PORTABLE LIGHTING SUNDRIES

Bakelite-cased Electric Cycle Lamps, Rear Lamps, Torches, Pocket and Portable Lamps.

LET US QUOTE FOR YOUR REQUIREMENTS

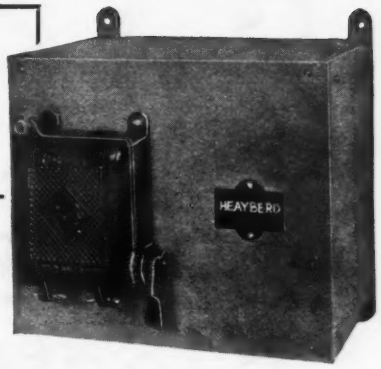
All Communications to Head Office and Works :
PENDLETON, MANCHESTER 6

Ward & Goldstone PENDLETON, MANCHESTER LTD.

LONDON DEPOT :
5 Percy St., Tottenham Court Road, W.1
Tel.: Mus. 8371-2

ESTABLISHED 1892

Safe lighting for AIR-RAID SHELTERS



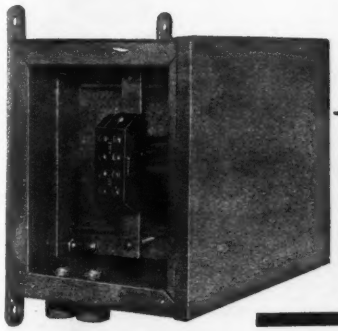
HEAYBERD

specialise in

TRANSFORMERS AND RECTIFYING EQUIPMENT FOR CHANGE-OVER SCHEMES, ELECTRO - PLATING PLANTS, BATTERY CHARGING, LIFTS, ETC.

HEAYBERD Low-Voltage Lighting Transformers render impossible the obtaining of more than half secondary voltage in respect to earth, thus removing the risk of severe shocks from lamps and flex if connected direct to the mains. HEAYBERD Transformers are double-wound, fitted with an earth shield between primary and secondary windings. Models are available in three types in rigid, strong, weather- and dust-proof steel cases suitable for wall or bench mounting. Outputs 12, 25 and 50 volts from 60 to 750 watts.

Write for Brochure 1032 listing Emergency Lighting Equipment complying with BS/ARP6 (Oct., 1939), and Brochure 1029 listing Rectifying Equipment.



F. C. HEAYBERD & CO. LTD., 10 FINSBURY ST., LONDON, E.C.2

Telephone : MET. 7516 (5 lines)

HEAYBERD LOW-VOLTAGE LIGHTING TRANSFORMERS

techdesign

J.M.C. PRECIOUS METAL CONTACTS

For absolute contact reliability in such apparatus as telephone relay switches, accurate remote control devices, voice frequency relays and similar light contact mechanism, the primary considerations are immunity from corrosion and oxidation, coupled with good arc-resisting properties. These conditions are adequately fulfilled by J.M.C. precious metal contacts.

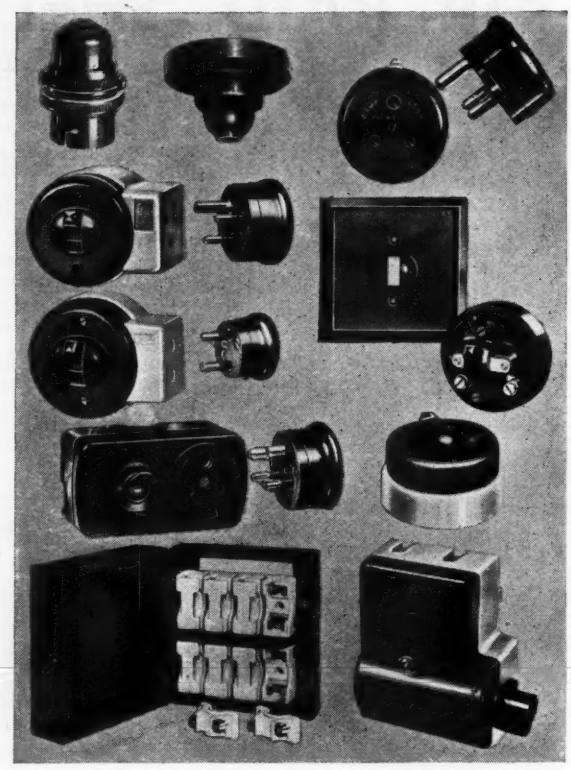
We are always ready to advise our customers on the most suitable metal to use for any specific purpose ; our technical staff gladly co-operate in the designing of specially shaped contact pieces.

★ *A workshop at the works of Standard Telephones & Cables Ltd. showing operatives assembling J.M.C. precious metal contacts.*

JOHNSON, MATTHEY & CO., LIMITED

73-83, HATTON GARDEN, LONDON E.C.1 Telephone: HOLborn 6989

G.E.C.
Electric Lighting Accessories



EVERYTHING FROM

MAIN SWITCH TO LAMPHOLDER

the largest variety of British-made Accessories

Manufactured by the pioneers of Bakelite accessories in Great Britain and complying with regulations and recommendations (wherever they apply) of the Home Office, the British Standards Institution and the Institution of Electrical Engineers

Over 30 G.E.C. branches are ready to serve—with stocks of all standard lines

ABERDEEN	BRIGHTON	DUNDEE	LEEDS	*NORTHAMPTON
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BLACKBURN	CARDIFF	GLOUCESTER	LONDONDERRY	READING
BLACKPOOL	CORK	HULL	LUTON	SHEFFIELD
*BOURNEMOUTH	CROYDON	INVERNESS	MANCHESTER	SOUTHAMPTON
*BRADFORD	DUBLIN	IPSWICH	MIDDLESBROUGH	STOKE-ON-TRENT
			NEWCASTLE-ON-TYNE	SWANSEA

* *Osram Lamp Sales Depots only*

Get into touch with your nearest G.E.C. branch NOW

POPPY DAY
HELPS EX-SERVICEMEN OF ALL WARS
★
PLEASE BE VERY GENEROUS
NOV. 11

Head Office at which large stocks are also held :

THE GENERAL ELECTRIC CO., LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2

NATIONAL EMERGENCY. *Please assist by saving all packing material for collection when our van calls*

Classified Advertisements

ADVERTISEMENTS for insertion in the following Friday's issue are accepted up to **First post on Monday**, at Dorset House, Stamford Street, London, S.E.1.
THE CHARGE for advertisements in this section is 1/2 per line per insertion, or for display advertisements 14/- per inch, with a minimum of one inch.
FOR SITUATIONS VACANT AND WANTED there is a special reduced rate of 1d. per word if prepaid, minimum 1/-. A Box Number, when required, is charged as six words, and there is also in this case an additional charge of 6d. for postage of replies. Three insertions under these headings can be obtained for the price of two if ordered and prepaid with the first insertion. If placed to account the charge for each insertion is 2/6 for three lines and 9d. for each additional line.

REPLIES TO advertisements published under a Box Number if not to be delivered to any particular firm or individual should be accompanied by instructions to this effect, addressed to the Manager of the ELECTRICAL REVIEW. Letters of applicants in such cases cannot be returned to them. The name of an advertiser using a Box Number will not be disclosed. All replies to Box Numbers should be addressed to the Box Number in the advertisement, c/o ELECTRICAL REVIEW, Dorset House, Stamford Street, London, S.E.1. Cheques and Postal Orders should be made payable to ELECTRICAL REVIEW LTD. and crossed. Notes cannot be traced if lost in transit. They must therefore be regarded as being despatched at sender's risk. Alternatively they may be sent per registered post.

Original testimonials should not be sent with applications for employment.

OFFICIAL NOTICES—TENDERS, ETC.

WEST MIDLANDS JOINT ELECTRICITY AUTHORITY

Contract No. 97

Wolverhampton Generating Station

Standard Frequency H.T. and L.T. A.C. Cables and L.T. D.C. Cables

THE Authority invite tenders for the supply, delivery, erection, laying and testing of cables at the above-mentioned Generating Station.

Copies of the conditions, specifications and form of tender may be obtained on payment of one guinea, which will, after the Authority have come to a decision on the tenders received, be returned to the tenderer, provided he shall have sent in a bona fide tender, and shall not have withdrawn it.

Additional copies can be obtained on a further payment of half-a-guinea per copy, which sum will not be returnable.

Cheques should be made payable to "West Midlands Joint Electricity Authority."

Tenders must be forwarded in the envelope provided so as to reach the undersigned not later than noon on Tuesday, November 12, 1940.

The Authority do not bind themselves to accept the lowest or any tender.

H. F. CARPENTER,
Clerk.

Central Offices of the Authority :—
Phœnix Buildings,
Dudley Road,
Wolverhampton.

October 21, 1940.

COUNTY BOROUGH OF BIRKENHEAD

Electricity Department

TENDERS are invited for the supply and delivery, over a period of 6 months, commencing 1st January, 1941, of the following materials :—

1. E.H.T. CABLE.
2. L.T. CABLE (PAPER INSULATED).
3. L.T. CABLE (RUBBER INSULATED).
4. ELECTRICITY METERS.
5. GENERAL STORES, INCLUDING BOLTS, NUTS, WOOD SCREWS, C.I. JOINT BOXES, INSULATING TAPES, CLEANING BRUSHES, EARTHENWARE PIPES, CABLE COVERING TILES, METER BOARDS, COOKER CONTROL UNITS AND SWITCH FUSES.

Forms of Tender, etc., from the Electrical Engineer, Craven Street.

Tenders, in plain sealed envelope, addressed "Town Clerk, Birkenhead," endorsed "Tender for ———," as the case may be (but not bearing any name or mark indicating the sender), must be delivered to me by 2 p.m., November 18th, 1940.

The Corporation do not bind themselves to accept the lowest or any tender.

Tenders not complying with these instructions will not be considered.

E. W. TAME,
Town Clerk.

October 21st, 1940. 4143

SITUATIONS VACANT

L.T. CABLE JOINTER

APPLICATIONS are invited for the above position from persons experienced in Jointing all classes of L.T. paper insulated Cables, Link boxes, and feeder pillars.

Wages and other conditions of employment in accordance with N.J.I.C. Schedule.

The successful candidate will be expected to contribute to the Authority's superannuation scheme and pass a medical examination.

Applications, stating age, experience, etc., endorsed "Cable Jointer," to be received by the undersigned not later than first post, Tuesday, November 12th, 1940.

W. V. SMYTHE,
Engineer & Manager.

Electricity Offices,
79, Caroline Square,
Skipton. 4138

SITUATIONS VACANT—*Continued*

BOROUGH OF MAIDSTONE ELECTRICITY DEPARTMENT

Junior Control Engineer (Temporary)

THE Corporation of Maidstone Electricity Department invite applications for the position of Junior Control Room Engineer, which is now vacant owing to war service. The length of the Appointment will probably be for the duration of the war.

Applicant must have had a proper Technical Training and previous experience in an E.H.T. (6,600v.) Control Room.

Salary :—N.J.B. Schedule, Glass G, Grade 9a. At the present time this is £263 p.a.

Applications, stating full experience and accompanied by the names of not more than 3 persons to whom reference can be made, to be sent to the Chief Engineer, Electricity Works, Maidstone, before 10 a.m., November 9th, 1940. 4145

NOTTS EDUCATION COMMITTEE.

County Technical College, Worksop.

Principal, A. E. Fox, M.C., B.Sc.

WANTED. Temporary Electrical Engineer to take Electrical subjects up to Higher National Certificate standard, and to assist generally in the Engineering Department.

For particulars and a form of application (which must be posted on or before November 6th) apply to the Principal. 4102

WORKS MANAGER

REQUIRED for an Irish Electrical Factory competent Works Manager with ability to handle staff. Must have good knowledge in the manufacture of electrical products covering Water Heaters, Cookers, Fires, Irons, etc. Experience in electro plating and vitreous enamelling desirable. Good prospects for suitable applicant. Apply in first instance to—Box 4124, c/o The Electrical Review.

ELECTRICAL ENGINEER

REQUIRED immediately Electrical Engineer. Expert in design and construction of Distant Recording Electrical Thermometers & Gauges.—Box 6115, c/o The Electrical Review.

VACANCIES exist for Civilian Morse and Procedure Instructors at the Electrical and Wireless Schools, Royal Air Force, at an initial rate of pay of £4 12s. 6d. per week, rising by annual increments of 2s. 6d. a week to a maximum of £5 2s. 6d. per week. Candidates must be able to send and receive morse at not less than 25 w.p.m., and should have had experience of lecturing and teaching, but consideration will be given to others who consider themselves capable. Applications should be addressed to the Under Secretary of State, Air Ministry (S.5.D.), London, W.C.2, giving full particulars as to previous experience, age, etc. Candidates will be required to appear before a selection board at the Schools for interview and test, but may be re-imbursed the cost of third-class locomotion expenses for this purpose. 3689

AN opportunity occurs for working electrician-wireman of good address and business capabilities, experienced, to join small suburban contractor. Must be neat and reliable worker on general repairs and installations, thorough knowledge of A.C. motors, good screwed tube hand. Top rate and commission for first six months pending proof of suitability for partnership. No finance needed, but must be conscientious worker and live in the district. North London. Apply, stating age, experience and references, to—Box 6108, c/o The Electrical Review.

SITUATIONS VACANT—*Continued*

ENGINEER SURVEYORS' ASSOCIATION

Registered Office: 20 Ogden's Chambers, 134, Deansgate, Manchester, 3.

FOUNDED 1914.

THIS Association, which is registered under the Trade Union Acts, was founded for the purpose of protecting the interests of Engineer Surveyors employed by the various Insurance Companies, etc., engaged in the examination and certification of Engines, Boilers, Electrical, Lift, Crane and other Power Plant.

Electrical, Lift and Crane Engineers who are contemplating entering the service of any such Companies referred to, are requested, in the first instance, to communicate with the General Secretary, when full information as to the Association's objects and scale of salary advocated will be forwarded.

All enquiries should be addressed to :—

THE GENERAL SECRETARY,
ENGINEER SURVEYORS' ASSOCIATION,
20, Ogden's Chambers, 134, Deansgate,
Manchester, 3.

Branches of the Association are established throughout the United Kingdom and Northern Ireland.

Address of any local Secretary will be sent on application. 4141

ASSISTANT Electrical Engineer is required for a large iron and steel works. Applicant should have a B.Sc. Degree or equivalent and have experience in maintenance of large A.C. and D.C. Motors, Control Gear, Rotary Converters, Generators and Distribution of E.H.T. and L.T. power. Age should be between 30 and 40, and applicants should submit full details of their training and experience to—Box 4120, c/o The Electrical Review.

CABLE company requires assistant foreman in rubber department. Applicants must have first-class experience in complete manufacture of all types of rubber cables. Excellent prospects for suitable candidate. State age, experience and salary expected to—Box 4136, c/o The Electrical Review.

CABLE company requires two or three experienced overhead linesmen, London area.—276 Knights Hill, West Norwood, S.E.27. 6075

CHIEF Inspector required, preferably ex-Tool Room, age over 40, must have full practical experience of the inspection of small precision work and assembly for aircraft, should be accustomed to A.I.D. procedure and specifications. English and Metric systems in operation.—Box 4107, c/o The Electrical Review.

COST Clerk required, not liable for Military Service. Write, stating age, qualifications, experience, salary required and nature of disability, if any.—Wessex Electricity Company, High Street, Wallingford. 6111

ENGINEERS required capable of supervising erection overhead transmission lines. State age, experience, salary, reference.—Box 4144, c/o The Electrical Review.

FOREMAN required to take charge of Fractional H.P. Armature and Field Coil Winding shop, accustomed also to small component assembly, core building, etc. Must have practical experience and possess initiative. Ability to control female labour. Only men with sound and proved ability need apply.—Box 4142, c/o The Electrical Review.

H. Clarke & Co. (Manchester) Ltd., Atlas Works, Patricroft, Manchester, are contemplating appointing a high-class Technician to increase the efficiency of their works. Applicants must be well versed in the manufacture of all classes of Micanite and Bakelite Products. Apply, in strictest confidence, to the above firm, stating age, salary and experience. 4146

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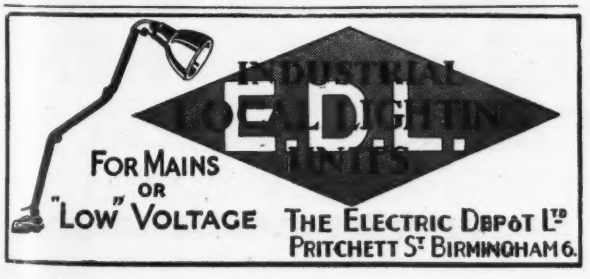

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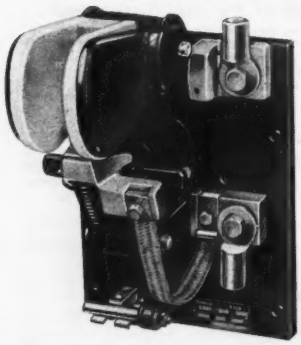

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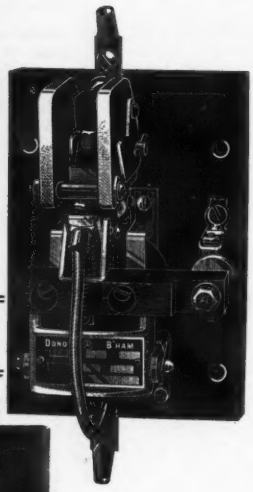

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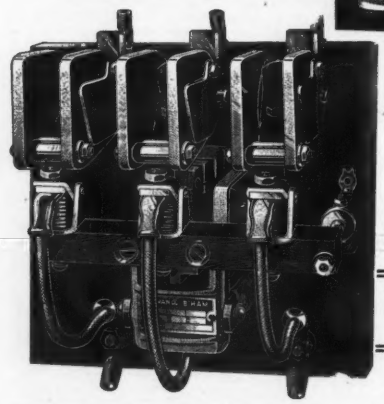

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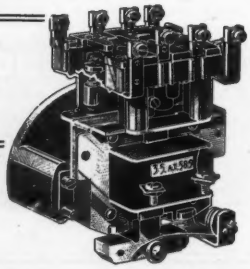

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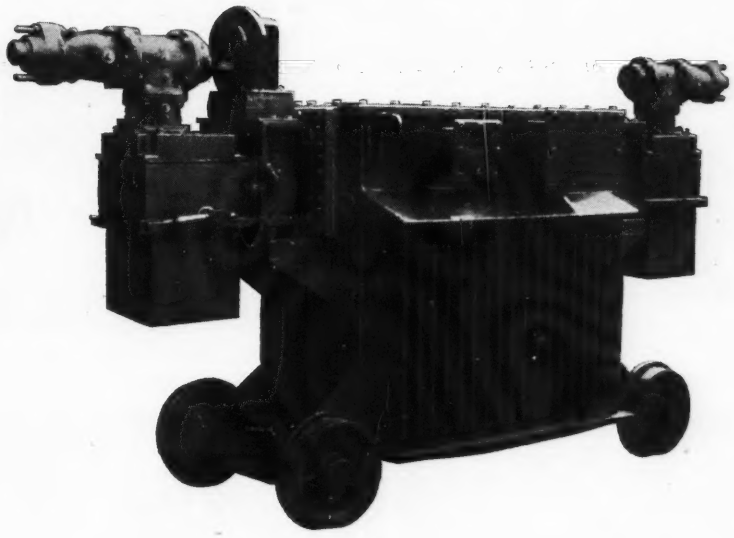

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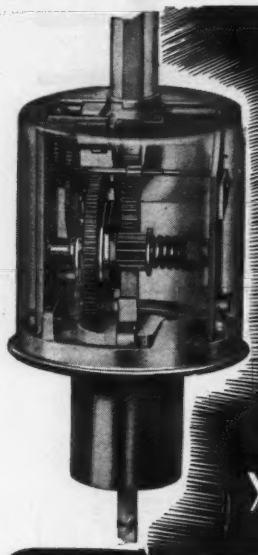

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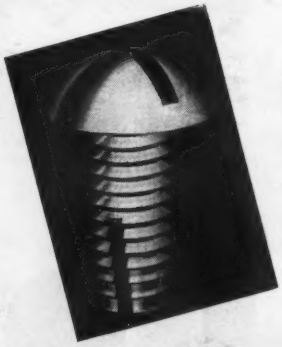

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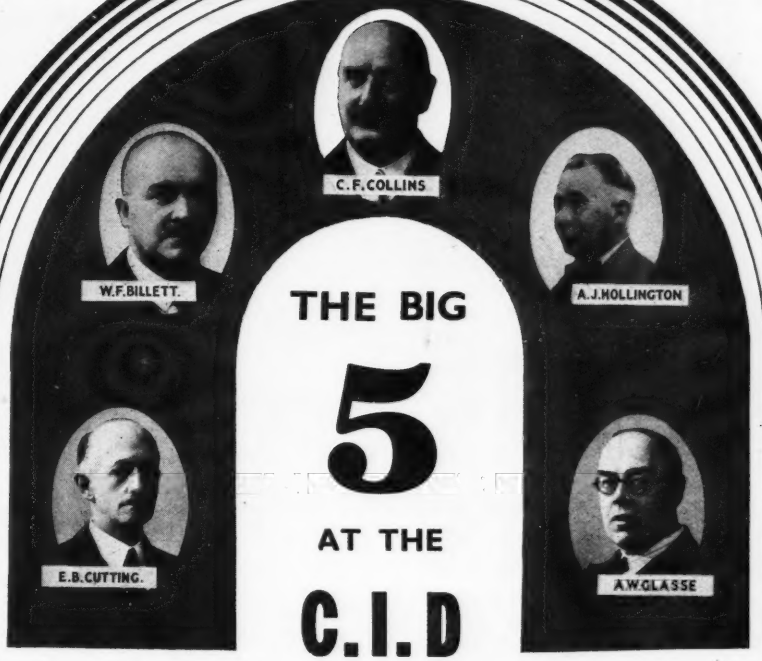

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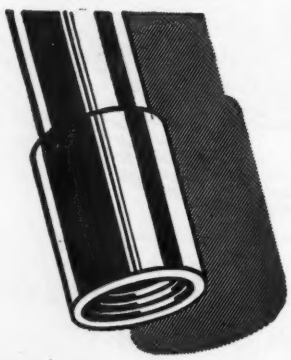

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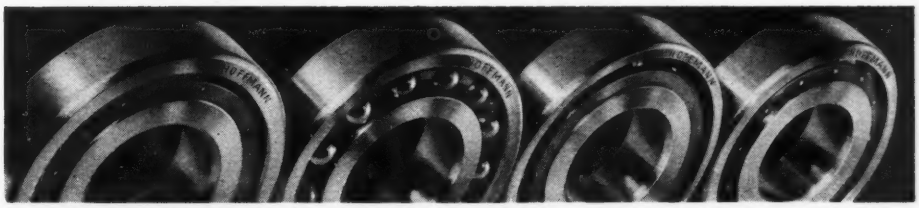

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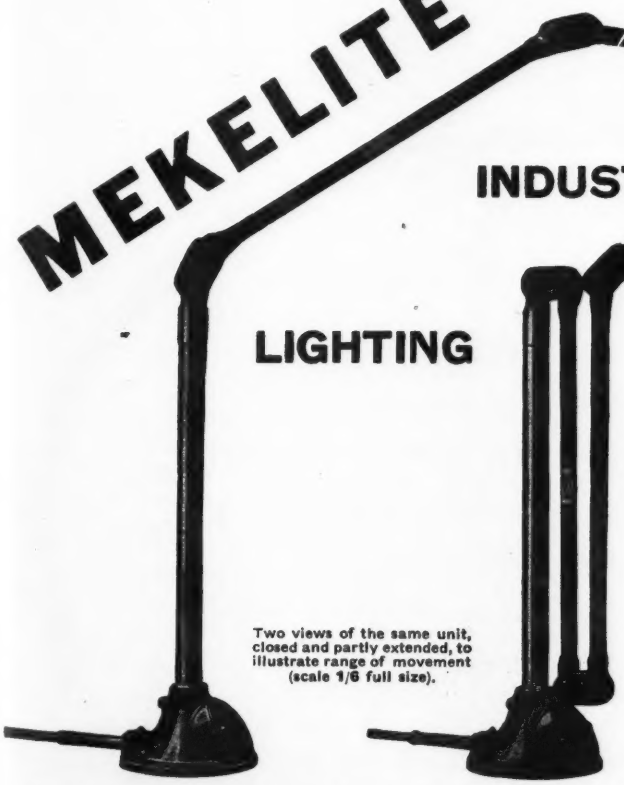

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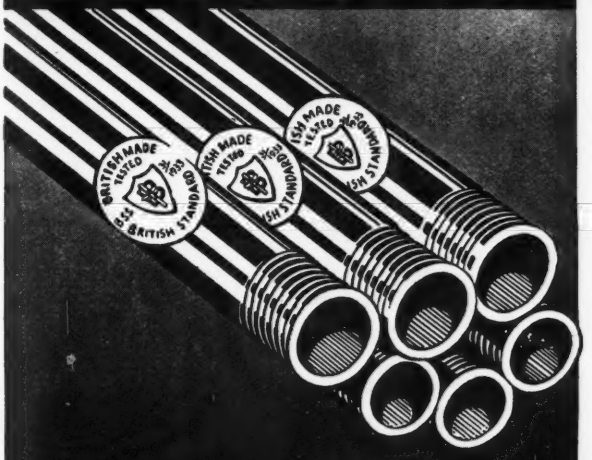

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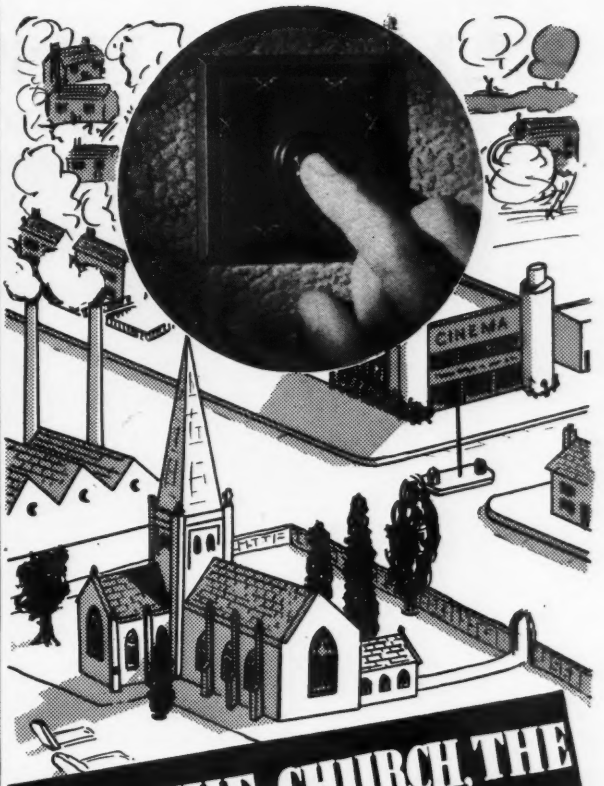

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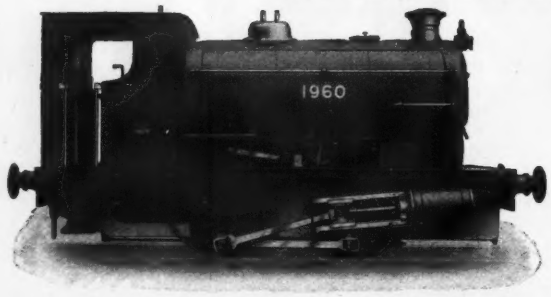

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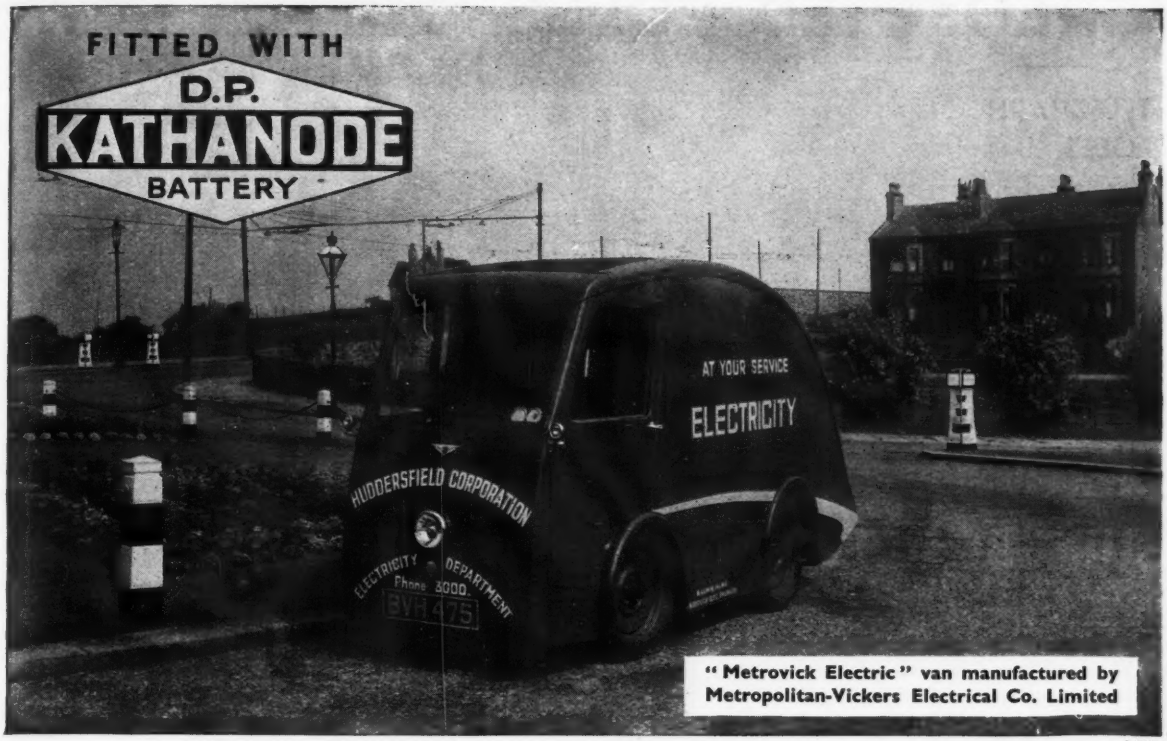

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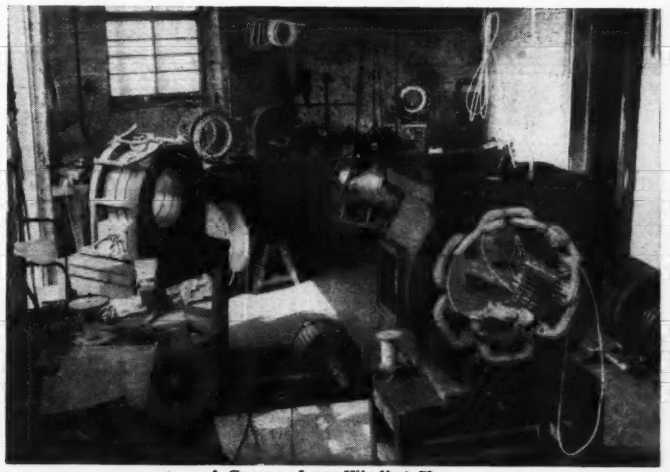

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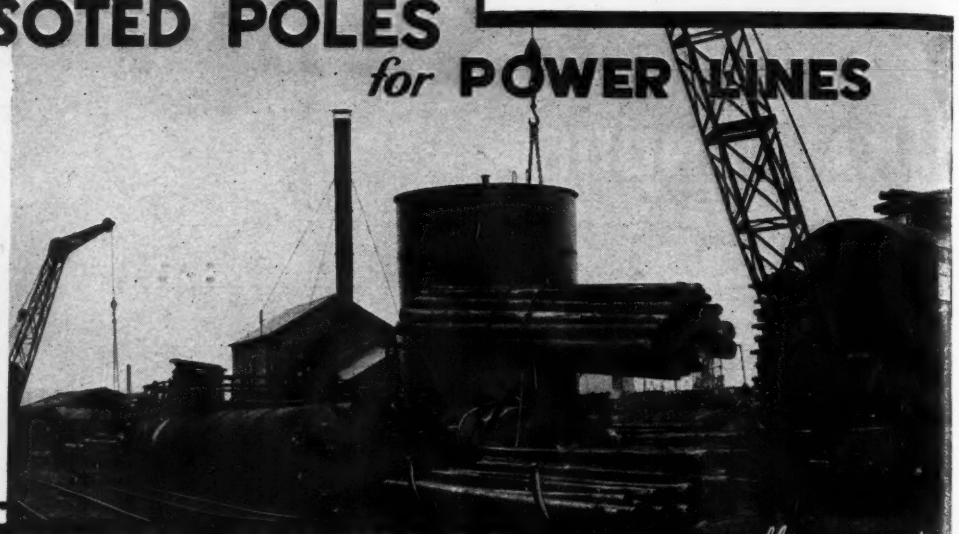

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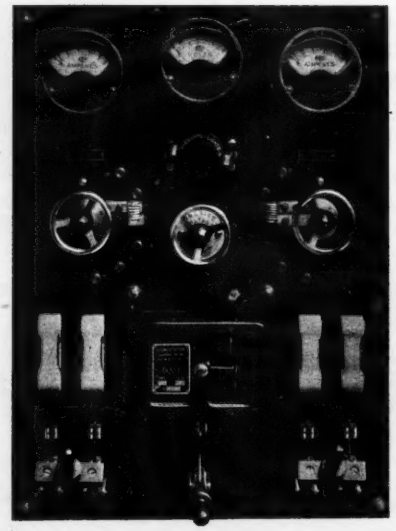

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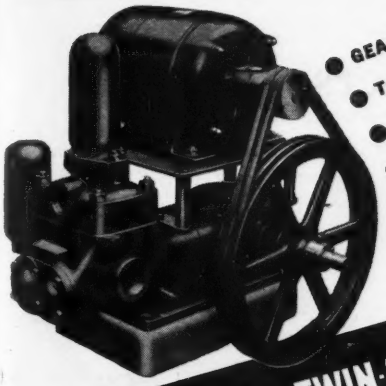

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Index to Advertisers

The following is a list of contract advertisers ; a page reference appears against those advertising in this issue.

	PAGE
Aberdare Cables, Ltd.	
Agro Electrical Co., Ltd.	
Airedale Elec. & Mfg. Co., Ltd.	
Allen, W. H., Sons & Co., Ltd.	26
Alton Battery Co., Ltd.	
Anglo-Hispano Trading Co., Ltd.	
Armorduct Cable Co., Ltd.	
Arrow Elec. Switches, Ltd.	
Assoc. of Steel Conduit Mfrs.	23
Austin & Hayes	
Automatic Coil Winder & Electrical Equipment Co., Ltd.	
Babcock & Wilcox, Ltd.	
Bakelite, Ltd.	40
Baker Platinum, Ltd.	41
Baldwins, Ltd.	
Barber & Colman, Ltd.	52
Belling & Co., Ltd.	12
Benjamin Electric, Ltd. (The)	33
B.B.N. Patents, Ltd.	66
Berry's Electric Ltd.	42
Bertram Thomas (Engineers), Ltd.	2
Bill Switchgear, Ltd.	3
Birkby's Ltd.	
Birmingham Aluminium Castings (1903) Co., Ltd.	
Birmingham Battery & Metal Co., Ltd.	
Birmingham Mica Co., Ltd.	68
Black & Decker, Ltd.	
Bowker, S. O., Ltd.	57
Bowthorpe Electric Co., Ltd.	
Bray, Geo., & Co., Ltd.	
Bridge Foundry Co., Ltd. (The)	
Britannia Batteries, Ltd.	
Britannic Electric Cable & Construction Co., Ltd.	
British Aluminium Co., Ltd.	
British Electric Resistance Co., Ltd.	30
British Electric Transformer Co., Ltd.	
British Insulated Cables, Ltd.	65
British Klöckner Switchgear, Ltd.	
British Mica Co., Ltd.	
British Power Transformer Co., Ltd.	
British Technical Cork Products, Ltd.	36
British Thomson-Houston Co., Ltd. (The)	5
British Timken, Ltd.	
Brittain's Electric Motor Co.	
Brook Motors, Ltd.	25
Brook, J. A., Ltd.	62
Brownings Electric Co.	61
Bruce Peebles & Co., Ltd.	2
Brush Electrical Engineering Co., Ltd.	6
Bull Motors	
Bullers, Ltd.	
Burdette & Co., Ltd.	62
Burgess Products Co., Ltd.	
Burn, G., Ltd.	57
Burt, Boulton & Haywood, Ltd.	62
Cable Makers' Association	
Callenders Cable & Construction Co., Ltd.	
Cambridge Instrument Co., Ltd.	
Castell, J. H.	
Caxton Wood Turnery, Ltd.	60
Chamberlain & Hookham, Ltd.	
Chloride Electrical Storage Co., Ltd.	32
City Electrical Co.	
Clarke, H., & Co. (Manchester) Ltd.	58
Clifford, Charles, & Sons, Ltd.	
Cohen, George, Sons & Co., Ltd.	50
Cole, E. K., Ltd.	28
Collingridge, & Co., Ltd.	60
Collins Electrical, Ltd.	53
Concordia Electric Wire Co., Ltd.	
Concordia Transformer Co., Ltd.	
Connolly's (Blackley), Ltd.	
Consolidated Pneumatic Tool Co., Ltd. (The)	7
Constructors, Ltd.	
Copper Development Association	62
Corfield-Sigg, Ltd.	
Cork Manufacturing Co., Ltd. (The)	
Crabtree, J. A., & Co., Ltd.	
Cressall Manufacturing Co., Ltd.	49
Crompton Parkinson, Ltd.	
Croydon Engineering Co., Ltd.	
Crypton Equipment, Ltd.	
Cryselco, Ltd.	32
Dacier, Ltd.	
Dalyte Electrical Co.	
Darwins, Ltd.	6
Davidson & Co., Ltd.	
Davis & Timmins, Ltd.	68
Davis Bros. Illuminating Engineers, Ltd.	
De La Rue (Thomas) & Co., Ltd.	29
Donovan Electrical Co., Ltd.	49 & 50
Dorman & Smith, Ltd.	
D.P. Battery Co., Ltd.	61
Drake & Gorham Wholesale, Ltd.	7
Du Bois, Ltd.	
Easco Electrical Service	
Edison Swan Cables, Ltd.	
Edison Swan Electric Co., Ltd.	18
Electric Construction Co., Ltd.	
Electric Depot, Ltd. (The)	49
Electric Elements Co.	
Electrical Contractors' Assoc.	49
Elliott Bros. (London), Ltd.	58
Ellison, George, Ltd.	Cover i
Ellison Insulations, Ltd.	62
E.M.B. Co., Ltd.	
Enfield Cable Works, Ltd.	
English Electric Co., Ltd.	9 & 19
Ensign Lamps, Ltd.	
Erskine, Heap & Co., Ltd.	15
Evans, Adlard & Co., Ltd.	
Evans, F. W., Ltd.	60
Evans, Joseph, & Sons (Wolverhampton), Ltd.	
Everett Edgcumbe & Co., Ltd.	
Evershed & Vignoles, Ltd.	
Falk, Stadelmann & Co., Ltd.	
Ferguson Pailin, Ltd.	
Ferranti, Ltd.	11 & 35
Fischer Bearings Co., Ltd.	
Fitter & Poulton, Ltd.	66
Flather & Co., Ltd.	
Fluxite, Ltd.	64
Foster Transformers & Switchgear, Ltd.	
Fowler, John, & Co. (Leeds), Ltd.	56
Fry's Metal Foundries, Ltd.	3
Geipel, William, Ltd.	
General Electric Co., Ltd.	16 & 46
Gent & Co., Ltd.	
Gilbert, A. C., & Co. (The)	
Gilson, D., & Co., Ltd.	
Gledhill Brook Time Recorders, Ltd.	
Glenfield & Kennedy, Ltd.	Cover iv
Glover, W. T., & Co., Ltd.	
Godwin, H. J., Ltd.	
Graham, Alfred, & Co., Ltd.	
Green Horace, & Co., Ltd.	
Grelco, Ltd.	
Grey & Marten, Ltd.	
Griffiths Bros. & Co., London, Ltd.	14
G.V.D. Illuminators, Ltd.	
Hampton Works (Stampings), Ltd. (The)	52
Harcourts, Ltd.	
Harland Engineering Co., Ltd. (The)	
Harris, A. E., & Co. (Birmingham), Ltd.	
Hart Accumulator Co., Ltd.	30
Heathman, J. H., Ltd.	64
Heatrae, Ltd.	1
Heayberd, F. C., & Co., Ltd.	45
Heenan & Froude, Ltd.	
Hellermann Electric, Ltd.	
Henley's, W. T., Telegraph Works Co., Ltd.	13
Hewittic Electric Co., Ltd.	
Heyes & Co., Ltd.	
Hick, Hargreaves & Co., Ltd.	38
Higgs Motors, Ltd.	
Hoffmann Manufacturing Co., Ltd.	55
Horton Manufacturing Co., Ltd. (The)	
Hotpoint Electric Appliance Co., Ltd.	
Howells (Electric Motors), Ltd.	63
Hyde, Silas, Ltd.	
Imperial Chemical Industries Limited	
I.C.I. Metals, Ltd.	
Igranic Electric Co., Ltd.	38
Ioco Rubber & Waterproofing Co., Ltd.	
Ismay, John, & Sons, Ltd.	

(CONTINUED ON PAGE 66)

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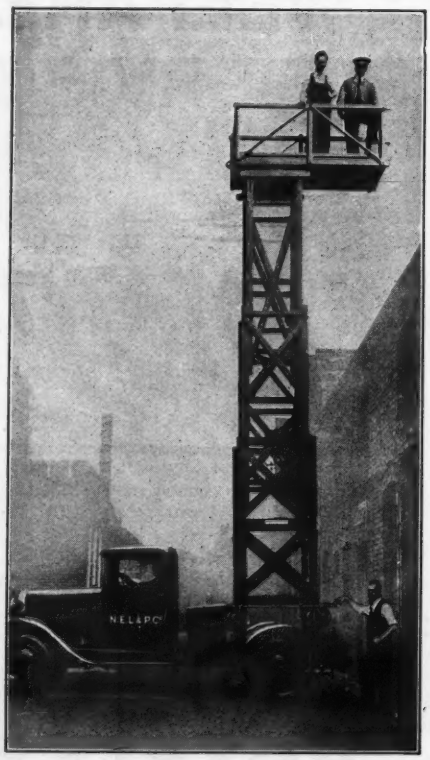

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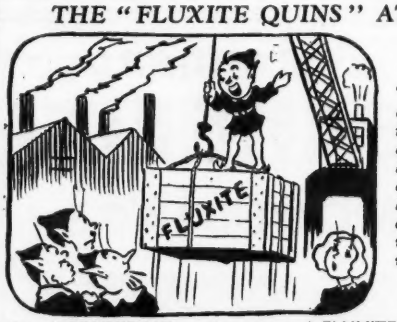

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Index to Advertisers—(*Continued from page 64*)

	PAGE
Jackson Electric Stove Co. Ltd.	
Johnson & Phillips, Ltd.	37
Johnson, Matthey & Co., Ltd.	45
Johnson (Richard) & Nephew, Ltd.	
Jones, Samuel, & Co., Ltd.	
Kautex (Plastics), Ltd.	
Key Engineering Co., Ltd.	Cover iii
Klaxon, Ltd.	
Lancashire Dynamo & Crypto, Ltd	20
Laurence, Scott & Electromotors, Ltd.	
Legg, B. J. (Industries), Ltd.	
Lewis, H. K., & Co., Ltd.	
Litholite Insulators & St. Albans Mouldings, Ltd.	63
Liverpool Elec. Cable Co.	
Lodge-Cottrell, Ltd.	59
Londex, Ltd.	
London Electric Firm	68
London Electric Wire Co., Ltd.	
Low (Archibald) Electrics, Ltd.	53
M. & C. Switchgear, Ltd.	
Macintyre, J., & Co.	54
Macpherson, Donald, & Co., Ltd.	
Macrome, Ltd.	36
Manganese Bronze & Brass Co., Ltd. (The)	
Marbaix, Gaston E., Ltd.	52
Martindale Electric Co., Ltd.	43
Mather & Platt, Ltd.	
Matthews & Yates, Ltd.	
McClure & Whitfield	
McGeoch, Wm., & Co., Ltd.	
McKechnie Bros., Ltd.	
M.C.L. & Repetition, Ltd.	1
Medway Corrugated Paper Co., Ltd. (The)	
Mek-Elek Engineering, Ltd.	55
Mercury Switch Manufacturing Co., Ltd. (The)	
Metallic Seamless Tube Co., Ltd.	54
Metropolitan-Vickers Electrical Co., Ltd.	10
Metropolitan Electric Supplies	
Micanite & Insulators Co., Ltd. (The)	
Midland Electric Manufacturing Co., Ltd.	31
Mirrlees Watson Co., Ltd. (The)	
"M.K." Electric, Ltd.	
Monmer Foundry, Ltd.	
Morphy-Richards, Ltd.	
Morse Chain Co., Ltd.	39
Moulded Products, Ltd.	
Multicore Solders, Ltd.	
Nalder Bros. & Thompson, Ltd.	
National Fire Protection Co., Ltd.	
National Register of Electrical Installation Contractors	49
Neill (James) Co. (Sheffield), Ltd.	
Nestlé, C., & Co., Ltd.	
Newman Motors	4
Nife Batteries, Ltd.	
Non-Ferrous Die Casting Co., Ltd.	62
Normand Electrical Co., Ltd.	
Northern Aluminium Co., Ltd.	
Ozonair, Ltd.	
Parmiter, Hope & Sugden, Ltd.	67
Parsons, C. A., & Co., Ltd.	
Partridge, Wilson & Co., Ltd.	59
Peckett & Sons, Ltd.	60
Peterborough Extensible Electric Lamps, Ltd. (The)	66
Petters, Ltd.	
Philips Lamps, Ltd.	11
Phosphor Bronze Co., Ltd. (The)	
Pinchin, Johnson & Co., Ltd.	
Pirelli-General Cable Works, Ltd.	
Poles (1938), Ltd.	
Pope's Electric Lamp Co., Ltd.	27
Premier Electric Heaters, Ltd.	
Price & Belsham, Ltd.	
Pritchett & Gold & E.P.S. Co., Ltd.	
Pulsometer Engineering Co., Ltd. (The)	
Pultra, Ltd.	
Pyrotenax, Ltd.	
Ransome & Marles Bearing Co., Ltd.	
Rawlplug Co., Ltd. (The)	
Ray Engineering Co., Ltd.	62
Reavell & Co., Ltd.	
Record Electrical Co., Ltd.	
Reeves & Co. (Birmingham), Ltd.	
Revo Electric Co., Ltd.	21
Reyrolle, A., & Co., Ltd.	22
Rhodes, Brydon & Youatt, Ltd.	
Richardsons, Westgarth-Brown Boveri, Ltd.	
Rix, G. A.	49
Robinson (Lionel) & Co., Ltd.	
Rollnick & Gordon, Ltd.	
Ross Courtney & Co., Ltd.	1
Rotherham & Sons, Ltd.	52
Rotoplunge Pump Co., Ltd.	
Rotunda, Ltd.	
Rozalex, Ltd.	63
Ruberoid Co., Ltd.	
Runbaken Electrical Products	
Ruston & Hornsby, Ltd.	
S. & D. Rivet Co.	
Sanders, W., & Co. (Wednesbury), Ltd.	68
Sangamo Weston, Ltd.	42
Sankey (Joseph) & Sons, Ltd.	
Sax, Julius, & Co., Ltd.	
Scholes, G. H. & Co., Ltd.	56
Scott, Hugh J., & Co. (Belfast), Ltd.	50
Service Electric Co., Ltd.	
Sheffield Smelting Co., Ltd. (The)	
Siegrist, E.	39
Siemens Bros. & Co., Ltd.	
Siemens Electric Lamps & Supplies, Ltd.	17
Simmonds Aerocessories, Ltd.	
Simmonds & Stokes, Ltd	Cover iii
Simon-Carves, Ltd.	
Simplex Electric Co., Ltd.	24
Sims, F. D., Ltd.	
Smith (Frederick) & Co.	34
Smith Meters, Ltd.	
Sparklets, Ltd.	
Spencer Wire Co., Ltd. (The)	
Spicers, Ltd.	Cover iii
Spiral Tube & Components Co., Ltd.	61
Standard Telephones & Cables, Ltd.	8
Statter, J. G., & Co., Ltd.	
Stirling Boiler Co., Ltd.	
St. Helens Cable & Rubber Co., Ltd.	
Stream-line Filters, Ltd.	
Sturtevant Engineering Co., Ltd.	
Suflex, Ltd.	
Sugg, William, & Co., Ltd.	68
Sullam, S. D., Ltd.	
Summers, J., & Sons, Ltd.	
Sun Electrical Co., Ltd. (The)	
Symonds, R. H., Ltd.	
Taylor, Charles (Birmingham), Ltd.	
Taylor & Petters, Ltd.	Cover iii
Taylor, Tunnicliff & Co., Ltd.	
Telegraph Construction & Maintenance Co., Ltd.	
Terry, Herbert & Sons, Ltd.	66
Thomas & Son (Worcester), Ltd.	63
Thorn Electrical Industries, Ltd.	
Titchfield Electro-Surgical Co., Ltd.	
T.M.C.-Harwell (Sales), Ltd.	60
Tourtel Manufacturing Co.	
Tucker, J. H., & Co., Ltd.	
Tudor Accumulator Co., Ltd.	
Tullis Russell & Co., Ltd.	
Tungstalite, Ltd.	60
Union Cable Co., Ltd.	
Universal Winding Co.	
Vactite Wire Co. (1919), Ltd.	
Vandervelde, L.	
Varley Magnet Co. (The)	
Vent-Axia, Ltd.	54
Veritys, Ltd.	43
Vincent Switchgear Manufacturing Co., Ltd.	
V.G. Manufacturing Co., Ltd.	
Vulcanised Fibre, Ltd.	
Walsall Conduits, Ltd.	
Wandleside Cable Works, Ltd.	
Ward & Goldstone, Ltd.	44
Ward, Thos. W., Ltd.	
Wardle Engineering Co., Ltd.	
Warsop Petrol Drill & Tools, Ltd.	
Webber, J. M., & Co., Ltd.	
Weekes L. (Luton), Ltd.	
Weir, G. & J., Ltd.	
Wells, A. C., & Co., Ltd.	
West Insulating Co., Ltd.	
Westinghouse Brake & Signal Co., Ltd.	Cover ii
Westminster Eng. Co., Ltd.	1
Westool, Ltd.	
Wiggins, F., & Sons, Ltd.	
Wolf, S., & Sons, Ltd.	
Wootton & Co., Ltd.	
Worthington-Simpson, Ltd.	
Wright, Bindley & Gell, Ltd.	
Yarrow & Co., Ltd.	
Yorkshire Electric Transformer Co., Ltd.	51
Young Accumulators, Ltd.	
Z Electric Lamps & Supplies Co., Ltd.	
Zenith Electric Co., Ltd.	

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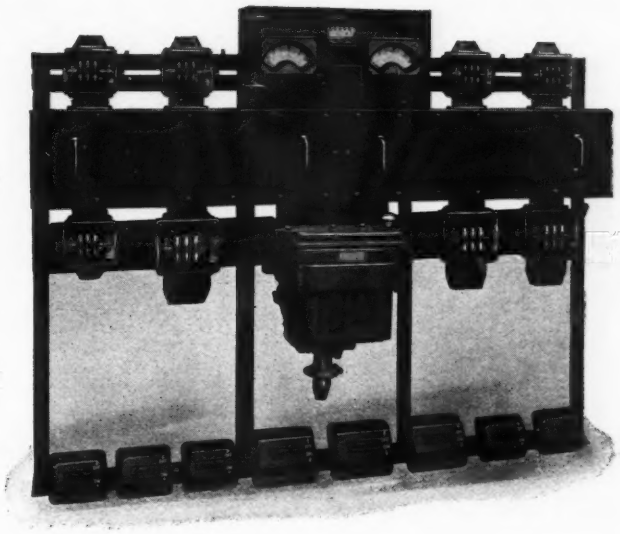

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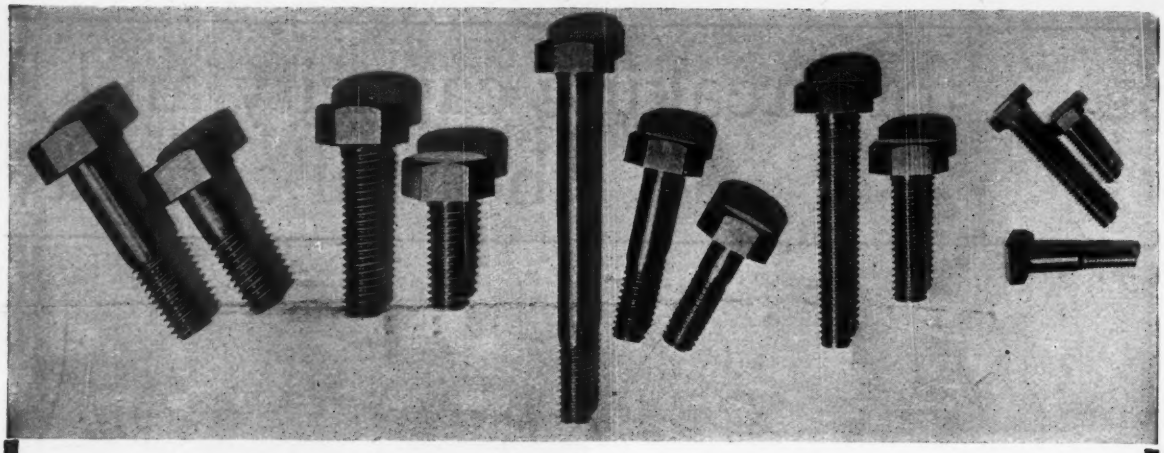

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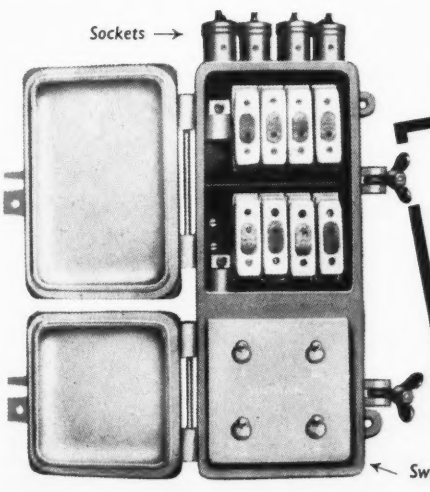

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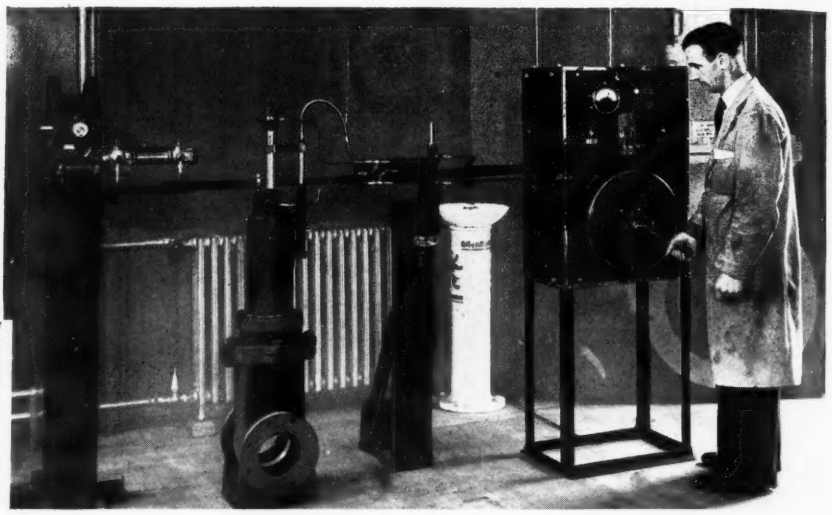
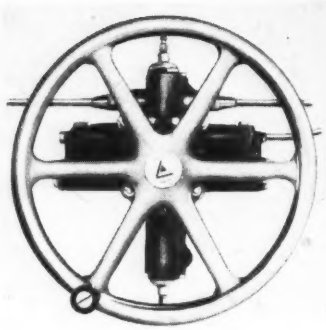
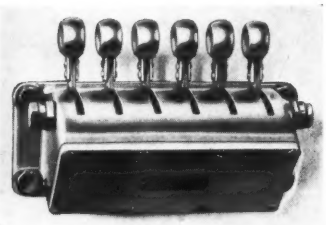
GLENFIELD-LOCKHEED REMOTE CONTROL

A new and highly efficient system of valve operation







The reliability, certainty of operation and efficiency which have led to the adoption of Lockheed Hydraulic Remote Control for many purposes, including the operation of retractable under-carriages in high-speed military and civil planes, have now been made available through the Glenfield-Lockheed system for the operation of valves, sluice gates, etc.

The system is intended for the manual operation from a central position of groups of valves, which may be of widely varying types and sizes, and separated by considerable distances. Formerly such remote control has required the use of power-driven units, which are complicated and uneconomical when the operating efforts are within the capacity of manual operation.

We illustrate (top) an installation in our showroom demonstrating the application of the Glenfield-Lockheed system to the operation of a ½" Single-Ported "Homeyard" Hydraulic Valve, a 6" Sluice Valve and an 8" Balanced Disc Valve, the Control Panel being provided with different types of indicators showing the position of the respective valves.

We also show in greater detail a manual transmitter and selector-valve block for the control of six separate valves, from which the compact nature of the installation will be observed.

Our bottom illustration shows Glenfield-Lockheed Control Gear fitted to an existing penstock for demonstration purposes. Normally, of course, the transmitter would be fitted at some distance from the valve, and would serve to actuate a number of penstocks through a suitable selector-valve block.

Please write for full particulars of this new and efficient development.

Glenfield

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